Ref 7/F

Unasylva

Volume VIII, Number 1 • March 1954
An International Review of Forestry and Forest Products

COMMONWEALTH MYCOLOGICAL INSTITUTE
27 APR 1954

OXFORD SYSTEM OF DECIMAL CLASSIFICATION FOR FORESTRY

The Conference of FAO and the Congress of the International Union of Forest Research Organizations have commended this system of classification for adoption by forestry libraries, institutes and documentation centers in member countries.

A definitive English text of the system prepared by the Joint FAO/IUFRO Committee on Bibliography in collaboration with the Commonwealth Forestry Bureau at Oxford, England, is shortly to be published. Translations into the official languages of both FAO and IUFRO are in preparation. Further announcements will be made regarding the price of the publication and the sales agents from which it will be available.

1953 Yearbook of Forest Products Statistics

This is the Seventh Yearbook of international forest products statistics to be published by FAO. It contains 1952 official information on production and trade and revised data for 1951, as reported by more than one hundred countries and territories in reply to a standard questionnaire.

The statistical tables are preceded by a short text which gives some salient features of the 1952 world situation. World and regional figures given here include estimates for non-reporting countries; in the statistical tables, the totals are for reporting countries only.

This Yearbook provides the most consistent and useful body of international forest products statistics now available. The tables cover the following topics:

- ROUNDWOOD
  - *Total Output*
  - *Sawlogs & Veneer Logs—Trade*
  - *Pulpwood—Trade*
  - *Pitprops—Output & Trade*
- PROCESSED WOOD
  - *Lumber, Plywood, and Sleepers — Production—Consumption—Trade*
- WOOD PULP, NEWSPRINT, PAPER AND PAPERBOARD, AND FIBERBOARDS
  - *Production—Consumption—Trade*
- WORLD TRADE — Summary
  - *Volume of Imports and Exports*
  - *Value of Imports and Exports*
- COMPARATIVE DATA
  - *Forest Products Balances*
  - *Per Caput Consumption of Forest Products*
  - *Forest Areas*

Available from FAO, Rome, or from all sales agents. Price: U.S. $2.50; 12s. 6d.

UNASYLVA is prepared by the Forestry Division and published quarterly in English, French and Spanish by the Documents Service at FAO's Headquarters in Rome. *FAO does not hold itself responsible for statements or views expressed by authors of signed articles.* UNASYLVA may be obtained from the sales agents listed above on this page. Annual subscription, US $2.50 or 12s. 6d. Single copy, 65 cents or 3s. 3d. Rates are payable *in local currencies* when orders are placed through local sales agents. A full series of back numbers is still available.

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Cover Photograph: *Italy. – The "white death" in the Val di Rhêmes, Italian Alps, caught in an impressive photograph. FAO comes into the field of avalanche control through its concern with erosion and forestry. Usually trees can do little to control an avalanche after the snow has begun to slide. The snow will first rush between the trees and then, as it gathers speed and weight, it will take the trees with it. But extensive tree plantings where the avalanches start can anchor the snow and so prevent them. Above the treeline the control measures must be engineering works. Many avalanches can be prevented and where prevention is not possible the time they will occur can usually be accurately foretold.*

A first international conference to discuss protection from avalanches will be held in Switzerland this summer under the sponsorship of FAO (see p. 29).

Photograph by courtesy of O. Bérard.

AN ESTABLISHED INSTITUTION

"To me FAO is now an established institution within which the shared interests of all member countries can find expression. We must devote concerted effort toward keeping this institution strong, competent, alert and active. It must be prepared to advise, to lead and to act. The difficulties we face must never be permitted to dim our vision of the objectives we aim to achieve. Let us strive jointly to aid the Organization in even more clearly relating its functions to our aspirations, in both the production and distribution aspects of the goals we seek."

With these words Philip V. Cardon of the United States responded to the recent Conference of FAO after he had been unanimously appointed as new Director-General of the Organization.

Describing the growth of FAO over the five-and-a-half years of his stewardship, the retiring Director-General, Norris E. Dodd, likened the position of FAO to that of an airplane: "When an airplane lifts from its runway," he said, "there is a critical period when it must be held in straight, level flight to stabilize itself before it takes up its cruising height and speed. In this sense FAO is now airborne. Adjust the fuel supply — that is, the budget — to the load you want FAO to lift and carry. Stabilize it when you have determined the best cruising height and speed. Give us all the load the plane can carry, but give us also the support to carry it."

The Conference responded to his appeal by raising the level of the Organization's regular income (aside from technical assistance funds which are allocated by the Technical Assistance Board in New York) to $6 million for each of the next two years. Not a very large sum but at least a token "that among the world's nations confidence has continued, and has grown, in the vitality and usefulness of FAO."

With the recent addition of Iran, Libya and Yemen, membership of FAO now stands at 71 nations — nations that have joined together through FAO to give a large part of mankind a hope for better times ahead. As Mr. Dodd expressed it in his farewell speech: "The ideas behind FAO were sound; they are sound. FAO is the best implement of peace, properly supported, that any government has in its whole arsenal; better than arms or planes or tanks or guns."

Figure 1. *Pulpwood billets being brought down a mountainside by a traditional forest railway in Yugoslavia. Efforts are being made to build roads and introduce motor transport to speed up extraction.*

Figure 2. *Loading cane for transport to a sugar mill in Cuba. The lack of baling, storing and transporting facilities is at present a limiting factor on the practical use of agricultural residues and their inclusion in the estimated supplies may therefore exaggerate the volume of real availabilities.*

Paper's New Raw Materials

by

THE ECONOMIST INTELLIGENCE UNIT, LONDON

The recent Conference of FAO reviewed a report entitled Preliminary Survey of the World's Pulp and Paper Resources and Prospects *presented by the Director-General, and which had been prepared in co-operation with the Secretariats of the Economic Commission for Europe, the Economic Commission for Latin America and UNESCO. This document gave a summary of a full report that has later this year to be transmitted to the Economic and Social Council of the United Nations (ECOSOC).*

The Conference, composed of representatives of the 71 Member Governments of FAO, commended the Director-General for the analysis presented and recommended that governments continue to explore, where desirable with FAO's assistance, long-term prospects for new pulp and paper production centers. Both governments and private investors should, prior to engaging funds and efforts in the building of new factories, undertake thorough investigations about prospective markets and production costs; suitability and continuity of the supply of raw materials; and the availability of water, power, chemicals, communication facilities, etc., at reasonable cost. The Director-General was invited to continue his studies of the world's pulp and paper requirements, and through proper study and investigation help governments to reduce the risk of misinvestments.

The following article is based on material prepared by The Economist Intelligence Unit, London, on behalf of FAO for incorporation into the report to be submitted to ECOSOC.

IN RESPONSE to a request from the Economic and Social Council of the United Nations, FAO has undertaken extensive investigations to determine what possibilities there are for expanding facilities for the manufacture of pulp and paper in order to meet growing future requirements. That requirements are steadily, and perhaps even steeply, rising is disputed by few. Each year that passes adds millions of newly taught to the world's literate population, and thousands of new factories to its industrial resources. By common consent, increasing literacy and industrial progress are the main sources from which the need for more paper arises. That the requirements for this necessity of civilized life might outrun the resources of conventional paper-making materials is, equally, a matter on which most people are agreed.

This combination of an expanding long-term demand for paper for all its manifold uses, with a comparatively inelastic supply of raw material from the traditional sources, forms the background against which FAO's work must be viewed. It provides the justification for broadening the raw material field, and it explains the solicitude of FAO for the development of partly or largely untried fibrous materials for paper-making. Naturally attention is focussed on tropical regions provided with tropical wood and non-wood fibrous plants, because so far relatively little has been known about the quantities, availabilities and paper-making qualities of these unconventional but potentially valuable materials.

The FAO publication *Raw Materials for More Paper* aimed at presenting a review of paper-making materials, covering their availability, uses and conversion processes, with particular emphasis on hitherto little-used materials. The fibrous materials available for paper-making are numerous and varied. So are the processes to convert them. The choice of the materials and processes used depends very much on the kind of paper produced, and there are a great many different kinds of paper. The choice, therefore, can be complicated and difficult. Confusion is sometimes added when people with little knowledge of the industry have to make decisions, especially when different or even conflicting advice is given by experienced authorities. Even more confusing can be the claims of inventors and promoters of new and untried processes.

The establishment of industries using new processes or new materials, or both, for the production of pulp and paper might thus give rise to serious controversies and failures. Evidently then, within the program undertaken by FAO for the development of new centers of production, a prominent place must be given to the examination of such questions as:

1. What are the possibilities for manufacturing pulp and paper from the various kinds of raw materials available?
2. What processes should be used, and for what kinds of paper?
3. If the use of new materials is technically possible, is it considered to be a feasible commercial venture?
4. What are the comparative manufacturing costs?

The purpose of the FAO publication already referred to is to outline the answers to these questions, by specifying for each major group of raw materials what pulping processes can be used, what kinds of paper it will yield, and at what cost different fibers could be processed by different methods. It is hoped that the information

provided will tell government officials, politicians or bankers, who are not technicians, what are the decisive criteria which determine whether or not their forests and fields are a possible commercial source of pulp and paper.

Raw Materials Available

The basic raw material of paper is cellulose in the form of fiber. Cellulose fiber occurs in many vegetable tissues, from which it can readily be extracted by mechanical or chemical means. Its sources are as numerous as the plant species from which it can be derived, and the number of species yielding fiber which could be used for paper runs into thousands. However, although there are many possible sources of fiber, in practice fiber suitable for paper can be extracted from only a few, for the fiber yield of most is so low that extraction does not pay.

Fiber-bearing plants range from common grasses to the most exotic of trees, but only about half a dozen sources are freely utilized. They are softwoods, hardwoods, straw, esparto grass, bagasse and bamboo. In addition, paper-making fiber is derived from cotton and linen in the form of rags, and from abaca, sisal and other hard fibers in the form of cordage[1]. Of these sources, wood, is at present far and away the most important, and coniferous wood alone makes a far greater contribution to total world supplies of paper-making materials than all other materials combined.

It would be interesting to calculate and compare the availabilities of the various raw materials for paper-making. But, for reasons stated below, only the broadest indication of resources can be given, and from such estimates as can be presented it is, of course, not possible to infer how much of each could be made available for pulping each year, and whether or not it is abundant.

First, most of the materials from which fiber for paper is extracted serve a great variety of uses. The extent to which they are available to the pulp and paper industry depends not only on their technical and economic merits for pulping, but also on the competing demands for them from other consuming industries, their accessibility and, not least, their popularity with paper manufactures. If coniferous wood, one of the most versatile of the world's primary materials, had no alternative uses, its supply would probably suffice to meet the pulp and paper industries' demands in full. Qualifications of this sort also apply to other fibrous materials. Naturally they limit the relevance and the usefulness of the estimates of resources.

Secondly, pulpable materials differ greatly in respect of both the processes by which they can be pulped, and the products which can be manufactured from them. Obviously the feasibility of utilizing a particular fibrous material—given its technical suitability—is determined by the nature and the costs of the process or processes appropriate to its conversion into pulp, as well as by the end-uses to which the pulp produced from it can be put. Thus, judged by the mere size of the world area covered with them, coniferous species might appear to be in plentiful supply. In fact, they are not, for most of them can be converted by any of the various pulping processes, and by some at low costs, while their end-uses in paper-making are more numerous than those of any other fibrous material—to say nothing of their manifold applications outside the pulp and paper industry. Tropical hardwoods, on the other hand, although experience has shown certain species to be technically suitable, and economic to pulp, have as yet only a small range of end-uses—one of several limitations hitherto retarding their exploitation. Resources of pulpable tropical hardwoods are potentially very extensive, but it has not yet proved profitable to turn them into active producing assets. The adequacy of resources must therefore be considered in relation to processes and products—and, again, to non-paper uses.

Thirdly, the amount of pulp obtained from a ton of raw material varies from one material to another. About two-and-a-half tons of esparto grass yield one ton of esparto pulp, and one ton of straw pulp requires from one-and-a-half to two tons of cereal straw, according to the type of straw used. At least two tons of wood are needed to make one ton of bleached wood pulp by chemical processes, but if the wood is processed mechanically, nine out of every ten tons ground are recovered in the form of pulp. Pulp yield then is another factor qualifying the estimates of raw material resources.

Fourthly, just as the supply of a raw material limits its consumption, so a limited demand for it may itself constitute a limitation upon the supply. For example, straw is commonly believed to exist everywhere in great abundance, available to pulp manufacturers in almost any quantity they can digest. But the surfeit may be more apparent than real, and in some countries the quantity of straw that can be made available for pulping, over and above other industrial and farm uses, is surprisingly small. The reason is that straw cannot be moved from field to factory if there are no facilities for baling, storing and transporting it, and farmers will not invest in the requisite equipment unless paper-makers assure them of continuity of purchases by means of long-term contracts. This, as is well known, paper-makers in certain countries are reluctant to do, since they are in the habit of buying wood pulp when they can, and straw only when they must. Demand tends to create a supply, and as the demand for straw expands, so does the supply to meet it. But where the movement of straw from farms to industry is not properly organized, such recoverable straw as is not used on farms is just left to rot, and its inclusion in the annual supply total of the country naturally exaggerates the size of real availabilities.

Coniferous Wood in Limited Supply

The growth of interest in alternative fibers has its roots in the long-term growth in the demand for paper of every description, particularly for newsprint and printing paper; and it has been accelerated by periodic post-war shortages of wood pulp. These shortages cannot be ascribed to merely temporary dislocations of paper production and trade, which will gradually give way under the impact of rising output. World output

[1] Considerable quantities of waste paper are of course made over into new paper.

of pulp and paper has strikingly expanded since 1945 and is now far greater than it ever was before 1939. Yet time and again supply has fallen short of demand, and in poor countries seriously so. Becoming increasingly literate as well as growing in population, many of the poorer countries cannot even secure the barest necessities of paper for their newspaper press, book publications and schools. Nor have successive waves of world inflation, of which the post-Korean commodity boom is the most recent example, done more than accentuate an underlying long-term tendency towards tight supplies and high prices of pulp and paper.

The failure of wood pulp production adequately to respond to the incentives of a good demand and profitable prices, reflects increasing pressure upon the limited resources of coniferous wood available for pulping. In many regions, coniferous forests have been subject to heavy cutting for so long that the maintenance of sustained yields would be threatened if more wood were to be cut than at present. Some countries may even have to cut less for a few years, to give their forests a chance to recover their vitality. With present methods of cutting, logging and transport, the volume of coniferous wood that can be taken from forests in use is unlikely to rise much above its current level—given the need to leave their productivity unimpaired. However, the world's demand for pulp, most observers agree, may rise by anything between 3.5 and 5 percent annually over the next 10 to 15 years to reach from 45 to 50 million tons in the early nineteen-sixties. This compares with the 1950 supply of 33 million tons. Unless fibrous materials other than coniferous wood are used, the paper industry may well be faced with the danger of outrunning its raw material resources.

It is true that a few untapped sources of conifers still remain in the Rocky Mountains of North America, in Canada and in Alaska. Probably the largest remaining stands are in the U.S.S.R. There are others in Central and South America, Oceania and Asia. Even with full development of the potential softwood sources, however, it appears unlikely that the rapidly growing requirements for pulp and paper all over the world can be met. And there are many countries with no softwoods at all.

Search for New Raw Materials

Developing an alternative raw material is always apt to call forth headshakings amongst the conservative-minded, especially when economic recession threatens, even if the product whose supply is to be supplemented is itself the outcome of a revolutionary change. Paper, in fact, is well used to shifts in its raw material basis. Its history is a record of continually interacting changes in end-products, manufacturing and raw materials. In the early nineteenth century, a tremendous expansion in the demand for paper followed in the wake of the industrial and intellectual revolutions sweeping over Western Europe. To cater for the larger demand, a manufacturing method more efficient than the traditional hand labour process had to be found, and, in response, the paper-making machine was invented. But, although the demand for paper was there, as well as the machine to make it cheaply and in quantity, the raw material was not. Paper was then made from cotton and linen rags; the supply of these had served paper mills in the preceding two centuries well enough, but it became totally inadequate with the advent of the industrial age. After decades of research and experiment the quest for a more abundant —and cheaper—raw material of good pulping properties resulted in the discovery that northern spruce, fir and a few other conifers answered all requirements. The discovery marked the beginning of the modern era of paper-making.

A further major stage in the history of paper's raw materials opened with the bringing of southern pine and a few temperate hardwoods into the range of pulpable species in addition to northern spruce and fir. Before 1930 or so the former species were generally held to be of indifferent pulping quality; at any rate, they could not be converted by the sulphite process, then the predominant chemical process, and they made poor groundwood pulp. But they did turn out to be suitable for pulping by the sulphate process; and the perfection of this process opened up a vast reservoir of hitherto unexploited material. It revolutionized the United States pulp industry, which was outstripping its native resources of traditional coniferous species growing in the north, and subsequently extended its operations into the pine forests located in the south. The coming of the sulphate process also facilitated the pulping of certain temperate broadleaved species.

Feasibility of Broadening Raw Materials Field

Yet another decisive stage may have been reached. Again papermakers are faced with a demand for paper tending to outpace the availability of conventional raw materials converted into products of conventional type or, at least, appearance. Again there is a need to tap sources of partly untried raw materials for conversion into products hitherto largely made from traditional raw materials. On technical grounds, as experience shows, no really valid objection can be raised against the feasibility of broadening the raw materials field by increased consumption of temperate broadleaved woods, tropical woods and the fibers from straw, bamboo and bagasse. Most of these materials already have some established applications. The task is to increase the consumption in such applications and, perhaps even more, to add to them.

As would be expected, the development of new raw materials on a laboratory scale has advanced beyond commercial practice. Numerous publications on the subject are available, and most of them agree that laboratory demonstrations have indicated beyond question the technical feasibility of utilizing those of the newer materials enumerated above. Most experimental work so far done, backed up not infrequently by experience from commercial operations, suggests that the newer materials discussed, pulped by processes particularly suited to them, present no technical problems that cannot be solved even though these are often formidable.

Technical suitability is, admittedly, not enough. Ultimately the feasibility of manufacturing paper from the so-called substitute materials is determined by economic factors. These limit the potential value for use of any resource. Even when no technical problems exist, the hard facts of economics may still preclude imme-

diate development of even the most promising materials in places remote from consuming centers inadequately provided with transport, and without the necessary industrial and financial resources, whether native or from abroad. Setting up pulp and paper mills without ensuring that all conditions necessary for economic operations are there, and not only the right raw materials, would be to court inevitable failure. Certainly the most careful assessment of conditions must precede the launching of a pulp project, especially in an underdeveloped country lacking in industrial experience.

Nevertheless, on production costs alone the new raw materials do not compare badly with the older ones. Some indeed are cheaper to process for pulp, at the present prices of the various fibrous materials concerned. The initial advantage of low pulpmaking costs may be lost in subsequent processing to convert the pulp into paper, just as its significance is somewhat lessened by the, as yet, restricted range of end-uses to which some of the newer pulps can be put. But, to say the least, the comparative cheapness of converting some of the newer materials (such as temperate hardwoods by the neutral sulphite semi-chemical process, or tropical hardwoods by the sulphate process) is a hopeful omen for the future.

General Conclusions

The underdeveloped countries of the world are on the threshold of vast and far-reaching changes, industrial, social and political. In their advance towards industrialization and a higher standard of life, paper for books, periodicals and newspapers, for writing purposes, and for such industrial uses as packaging, will play an increasingly important role. Indeed their future progress depends in no small degree on the availability of abundant and cheap paper and paper-making materials. Yet it is exactly in these countries, which need more paper most, that this product, so vital to civilization, is usually scarcest and dearest.

Over the next decade, world demand for pulp and paper is expected to increase by 3.5 to 5 percent a year. It is by no means certain that this increased demand can be met by the main production centers —that is, by North American and European industries using coniferous wood for paper. There is a strong case, therefore, for increasing the supply of pulp and paper in underdeveloped countries by harnessing those of their fibrous resources from which production of pulp and paper is technically and economically feasible. Such resources exist, as yet largely unused. They include broadleaved forests of great extent, millions of acres covered with fiber yielding plants, and renewable agricultural residues available in tonnages of stupendous size.

The mere existence of such potential resources, however, proves little except that, for a complex of reasons, exploitation has not yet proved profitable. But FAO has endeavored to show that exploitation is frequently possible, as well as desirable. The main conclusions reached can be summarized as follows:

1. Tropical bamboo cane, bagasse, straw and various other agricultural residues, constitute suitable raw materials for the manufacture of pulp and paper on industrial lines.
2. Provided that these potential sources of fiber are utilized, there can be no doubt that the world's supply of pulping raw materials is plentiful, and even abundant to meet any conceivable increase in the world's prospective requirements for pulp and paper.
3. A variety of well-established pulping processes is available for the conversion of the heretofore unconventional raw materials.
4. Generally speaking, chemicals, power, transportation, and, above all, money, are more costly in underdeveloped countries than in industrial areas, and it requires far more capital to establish an efficient pulp and paper mill in those countries than in North America or Scandinavia. The effect of these additional cost elements is, however, frequently offset by the existence of cheaper raw materials and labor.
5. There is sufficient economic promise in the manufacture of paper from the newer raw materials to warrant the thorough examination of a number of projects for setting up new pulp and paper producing units in the tropics.

These conclusions call for a few comments. First, while all the principal pulping processes have some applicability, only a few can be applied, for instance to complex mixtures of species such as are found in tropical forests. In general, only alkaline processes —particularly the sulphate process—appear to be suited for tropical broadleaved mixtures. Secondly, mechanical pulp, the chief ingredient of newsprint and cheap printings, can be produced from no agricultural fibers, from only very few broadleaved tropical woods and from not many broadleaved temperate woods. But, thirdly, the pulps produced from these materials are suitable for blending with coniferous wood or bamboo pulps; and this is one important reason why more consideration should be given than in the past to the production of paper from mixed types of pulp. Fourthly, although paper produced from unconventional materials in underdeveloped countries may be dearer than the imported product, it may also happen that, because of currency restrictions, import restrictions, and political considerations, the cheaper foreign product is not imported anyway. In such circumstances the internal economy of the country would benefit from local manufacture of pulp and paper even at costs involving a temporary fiscal loss.

But it is unwise to generalize on such elusive phenomena as costs. Each individual proposal necessarily differs from any other and should therefore be examined on its merits. Many factors interact to determine whether or not a particular project is economic. These factors cannot be evaluated except through the most careful study and investigation.

In the initial stage of locating pulp and paper plants in tropical regions attention must be centered on a few especially suitable areas. If proposals are over-ambitious, too widespread and diversified, discouraging failures may result, and the entire program may suffer.

As regards a mill dependent on forest resources, planning consists of four major stages:

1. The selection of the site for the mill as determined by the proximity of raw materials, water and power facilities, transportation, etc.

2. A forest survey to determine the size and composition of the stand. (This cannot be accomplished by aerial survey alone; statistical sampling methods should also be used).
3. Experimentation on laboratory and industrial scales.
4. The planning of the plant and the choice of process it uses, following on the preliminary steps indicated under 1. to 3.

All future experimentation with making paper from tropical wood should be associated with close examination of the composition of the forest from which the experimental material comes, in order that the process adaptability of the species available may be gauged. Likewise silvicultural research into tropical broadleaved species should be greatly intensified, to provide prospective owners of mills with the necessary knowledge as to growth and yields, and even more, as to the practices that will ensure a perpetual supply of desirable species.

Few will dispute that there are important if, at present, limited possibilities for making paper from tropical broadleaved woods. In so far as mills to utilize these woods are established in underdeveloped countries — and this can be taken to be the rule — they are likely to increase the tempo of industrialization in such countries, just as increased industrialization will in turn accelerate the development of pulp and paper mills by making available to them more chemicals and equipment from nearby domestic sources. As this interaction proceeds, growing experience in manufacturing and marketing the papers made from tropical wood—possibly also in competing on foreign markets where product quality is of supreme importance—may further contribute to accelerate their production and consumption.

There is every reason to believe that this large and unexploited resource can make a vital contribution towards raising the standard of living in tropical countries. Inevitably there must be a period of trial — and error. But if the technical and economic means already available are wisely used, there can arise a pulp and paper industry in the underdeveloped parts of the world that will be of world importance.

FORESTRY EDUCATION IN HAITI

An FAO forest officer in Haiti has been at work since 1951 assisting in improving the organization of the forest service and helping the Forestry Division of the Department of Agriculture to prepare programs of reforestation and soil conservation. Haiti's 1,625 million acres (ha. 650,000) of forest cover about one-quarter of the land area. Population pressure and lack of understanding of the effects of forest denudation have caused the forest rapidly to disappear.

One of the chief tasks of the FAO officer has been to help instruct the farming communities in the hills on the advantages of forest conservation and tree-planting as a means of arresting soil erosion and of regulating water flow. Seedlings of useful species have been distributed successfully in various localities. Working through schools and Boy Scout troops, and enlisting the support of religious organizations, the Forest Service has been able to stimulate a commendable awareness of forest values. Instruction and demonstration are adjusted to the mentalities and attitude to life of the villagers themselves. School books and leaflets have been produced to foster the innate pride of the local people in their land. The cover illustration shown was sketched by a Haitian artist, Mr. Alix Roy.

Introduction of Exotic Trees

Dangers From Diseases and Insect Pests

by J. S. Boyce
Professor of Forest Pathology, Yale University, U.S.A.

The Seventh Session of the Conference of FAO urged extension of the facilities afforded by FAO for the international exchange of forest seeds and planting material. It is as well that the dangers attaching to the introduction of exotic species should be kept in mind. Some of these are discussed in this article, which is an extract from a study, later to be published, prepared by Professor Boyce for FAO in connection with the Organization's program of work on afforestation and reforestation.

In large-scale planting programs the general tendency is to establish pure plantations of exotic conifers because the keenest demand throughout the world has always been for softwoods. North America has been the only continent with sufficient volume and variety of species to fulfill all requirements for such exotics. Furthermore, certain North American conifers grow so much more rapidly than conifers in other parts of the world, that it has been only natural to attempt to establish them wherever there is need for softwoods. Exotics should, however, be introduced only if they fulfill some definite need not met by native species, and it must be remembered that many years are required to learn enough about an exotic to determine whether or not it can be successfully established and perpetuated.

The introduction of exotics continues to be based largely on trial and error. Inherent difficulties are first, the problem of securing seed of correct provenance; second, the difficulty of proper site selection; third, the question of whether an exotic will be silviculturally and commercially desirable, even on the best sites, in its new home.

By means of measurements of climate and soil it should theoretically be possible to ascertain the exact ecological habitat of any species or of its races, if the species is not racially uniform, and then to find suitable equivalent habitats elsewhere, no matter how geographically remote. In practice, the time and money necessary to do this may be considered prohibitive. Moreover, it may be desired to plant an introduced species in pure stands, even though the tree naturally grows in mixture. A species normally growing in mixture is more or less dependent on the other species for its welfare, probably in some instances to such an extent that it cannot succeed without them or their equivalents; and finally it is impossible so far to evaluate pathogenic factors, which can cause the failure of an exotic even though climatic and soil factors are favorable.

There are three great hazards from parasites in the use of exotics:

1. a parasite of minor significance on the exotic in its native habitat may be introduced along with it and become extremely severe under new conditions;
2. the exotic will encounter a parasite in its new environment to which it has no resistance so that the tree will be valueless;
3. a parasite of the exotic may be introduced which will be exceedingly destructive to a native tree.

Experience with exotics in Europe

Tree species, particularly conifers, have been introduced from all over the northern hemisphere into western Europe, and this is an unsurpassed region in which to obtain information on the behavior of exotics. It is notable that, after more than two centuries of experience, the majority of foresters in western Europe are inclined to be pessimistic regarding exotics, because they have not yet found a completely successful introduced tree, even though certain species showed great initial promise.

There is justification for the introduction of exotics into countries with a few commercially valuable tree species. Europe, for example, has relatively few species of value; parts of it do not have any native conifer that attains timber size, and in the whole of Europe there is not, for example, a single pine yielding softwood of such highly desirable quality as eastern white pine (*Pinus strobus* L.). The only white pine in Europe is Balkan pine (*P. peuce* Griseb.) which occurs to a limited extent in the mountains of the Balkan Peninsula, but the wood is almost as heavy as that of Scots pine (*P. sylvestris* L.). Furthermore, the native European trees grow slowly, so there has been a search for faster growing species. Eastern white pine grows more rapidly than the native European conifers with which it has been associated. In northern Germany near Eberswalde, the writer has seen 45-year-old Douglas fir (*Pseudotsuga taxifolia* (Lam.) Br.) of the same size as 100-year-old Scots pine. Near Tharandt, 55-year-old Douglas firs were from 14 to 20 inches (36 to 51 cm.) in diameter at breast height, exactly twice the size of Norway spruce (*Picea abies* Karst.) of the same age mixed with them. In southern Germany, near Munich, 45-year-old planted Douglas fir was the same height as 77-year-old naturally reproduced silver fir (*Abies alba* Mill.).

The first exotic to be extensively planted in continental Europe was eastern white pine, introduced in 1705. At first of great promise and hailed with enthusiasm, it finally encountered an unpredictable pathogenic factor — white pine blister rust caused by the rust fungus, *Cronartium ribicola* Fisch., a migrant from Asia — with the result that the tree was all but abandoned throughout Europe. Of late years it is again finding some favor because in certain localities there are no, or few, susceptible currant and gooseberry bushes (*Ribes*) so that the tree is able to survive. In fact, where the rust fungus does not occur, or where

it is no more serious than a tolerable nuisance, the tree is completely fulfilling the true test of a successful exotic, which is that it maintains itself by natural reproduction in competition with the native species. The wide range of soils on which white pine will grow vigorously in Europe is impressive. Both in Upper Silesia near the former Polish border and in Switzerland, the author has seen it flourishing on pure peat. In Switzerland also he saw superb mature trees which had developed in mixture with beech (*Fagus sylvatica* L.), Scots pine and a little Norway spruce. In southern Germany the tree was seen in its fourth generation, the first two generations having been planted and the second two naturally reproduced.

Following World War I, Douglas fir found high favor and was planted extensively, although enthusiasm diminished somewhat in time because of the low quality of wood produced. The first pathogenic factor to threaten the tree was Phomopsis canker caused by a European fungus, *Phomopsis pseudotsugae* Wilson. This turned out to be not as serious as first feared, being largely connected with frost. Next was Rhabdocline needle cast caused by *Rhabdocline pseudotsugae* Sydow — the causal fungus coming from the native home of the tree, but with its virulence apparently increased by the damper European climate during the growing season. Fortunately, only the intermountain and Rocky mountain or blue forms of the tree were attacked, the coast or green form, the really valuable kind for Europe, being unmolested. At about the same time an aphid, *Adelges cooleyi* Gill., attacking the coast form was causing some concern, but it proved to be tolerable. Adelopus needle cast, now a severe disease, apparently caused by the fungus *Adelopus gäumanni* Rohde which seems to attack all three forms of the tree, has made the future of Douglas fir in Europe dubious. Planting of the species has been given up in much of southern Germany, while in Switzerland it is being used in mixture only, not with the idea that the mixed stand as such will check the disease, but merely to have other species to take the place of Douglas fir in the stand should the disease prove as catastrophic as is now feared.

In view of the difficulties besetting Douglas fir, it was natural that Sitka spruce (*Picea sitchensis* (Bong.) Carr.) should increase in favor and by 1935 it was thought that this species might supplant Douglas fir for extensive planting. However, in 1939, in Holland, the author saw the last of what had been a fine 40-year-old stand of Sitka spruce. In 1935, when this stand comprised nearly 300 trees per acre (741 per ha.), a few began to die from attack by a bark beetle, *Dendroctonus micans* Kugel., which soon reached epidemic proportions, and by 1939 only 30 trees per acre (74 per ha.) remained. These were clear cut within a few years. Similar beetle attack has occurred elsewhere, and it now seems doubtful whether Sitka spruce can be grown to a greater age than 40 to 50 years in western Europe. *D. micans* occurs naturally on Norway spruce (*Picea abies* Karst.) but causes little damage.

Sitka spruce is also vigorously attacked by a louse or aphid, *Elatobium* (*Aphis*) *abietinum*, which causes considerable defoliation in some plantations, but whose seriousness cannot yet be predicted.

Plantations of the same species which have failed at 20 to 45 years old with no pathogen responsible have been seen in Germany, Switzerland and Great Britain and it would seem that failure has clearly resulted from an unsatisfactory site. Sitka spruce is exacting in its site requirements, and too often has been planted on unsuitable soil, where the annual precipitation is too low, where temperatures are too severe or where some other adverse factor occurs. Unfortunately, the bad effects of an unsuitable site frequently do not appear until some years after a stand has been established, growth of the earlier years being vigorous. Sitka spruce on the whole is better adapted to Great Britain, where the climate is nearer that of its native habitat, than to most of continental Europe. Even so, care must be exercised in selecting the areas where it is to be established.

Grand fir (*Abies grandis* Lind.) is now being most favorably regarded by many foresters in western Europe because of its rapidity of growth and, up to the present, freedom from disease. It is thought that it may ultimately take the place it was first hoped that Douglas fir would occupy, and next Sitka spruce, neither of which are fulfilling their original promise. For example, in Great Britain grand fir will grow more rapidly than any other conifer. However, unless the site has a mean annual precipitation of 50 inches (1,270 mm.) or more, growth declines at about the age of 50 years and the trees are no longer vigorous, although no definite disease may have developed. Of course, since grand fir occurs over a wide geographical range in its native habitat with marked variations in temperature and precipitation, and since consequently there are climatic races within the species, it would be possible to find a race adapted to drier conditions, but such a race would probably grow so slowly that it would have no advantage over native European conifers. The grand fir which the author saw in Europe was all of the fast-growing coastal form.

Grand fir planted in 1894 near Lausanne, Switzerland, has been dying steadily since 1945 because of shoestring root rot caused by the honey mushroom (*Armillaria mellea* (Vahl.) Quel.) and by 1950 it appeared likely that the remaining trees would die in a few years. Basically the cause seemed to be drought, since precipitation in this locality averages only 40 to 50 inches (1,016 to 1,270 mm.) annually and, in addition, for the 7 to 8 years prior to 1950 there had been an annual precipitation deficit as high as 30 percent in some years. Severe attacks on conifers by *Armillaria mellea* following drought are characteristic.

Western red cedar (*Thuja plicata* D. Don.) is little seen in continental Europe, probably because in Great Britain the tree had so much difficulty in even getting a start that it was quickly discredited. The cedar leaf blight fungus (*Keithia thujina* Durand), which came with the trees from North America, finding the moist climate of Great Britain so much to its liking has reduced the cedar to a slow-growing tree, at least during its younger stages.

In southern Sweden a flourishing plantation of 12-year-old jack pine (*Pinus banksiana* Lam.) was ruined by a fungus (*Dasyscypha* sp.) which ordinarily occurs as a harmless saprophyte on the native Scots pine. The fungus caused flattened cankers on the main stem just above ground level, and many trees were completely girdled.

Caucasian fir (*Abies nordmanniana* (Steven) Spach.),

introduced from the western spurs of the Caucasian mountains largely as an ornamental, was followed by an aphid (*Adelges nüsslini* Börner). In the Caucasus this insect is not significantly damaging to its host tree, but in southern Germany under relatively drier climatic conditions the parasite has become so severe that Caucasian fir can no longer be grown there. However, this is of little consequence compared with the fact that the aphid is now attacking silver fir so severely that foresters fear that this fir, which is the principal species in the famous Black Forest, will have to be largely abandoned, particularly on those sites below the natural lower altitudinal limit for the tree.

Exotics in the United States

In the United States, because of the large number and variety of native species there is little need for exotics, and so far they have been tried in a small way only. In Michigan, Scots pine was attacked by a gall rust (*Peridermium* sp.); Himalayan pine (*Pinus excelsa* Wall.) was so damaged by canker with which *Valsa superficialis* Nitschke was associated that ultimate destruction of the plantation was certain; Japanese red pine (*P. densiflora* Sieb. and Zucc.) was considerably affected by dieback of the leaders and branches probably caused by *Cenangium abietis* (Pers.) Rehm, and Austrian pine was completely destroyed by sweetfern blister rust, *Cronartium comptoniae* Arth. Ornamental Austrian pines in the northeastern United States are so susceptible to dieback of the twigs caused by *Sphaeropsis ellisi* Sacc., also known as *Diplodia pinea* (Desm.) Kickx., that this factor alone, apart from other pests, probably makes the tree valueless for forest planting. Scots pine plantations in Pennsylvania grew vigorously for 20 years and then disintegrated quickly from various factors including attacks by fungi. In the State of New York, Scots pine plantations have been extensively damaged by the spittle bug (*Aphrophora parallela* Say.) which has killed practically all trees over 20 years old. Elsewhere in the state this tree has been severely attacked by the Woodgate gall rust.

Both Norway spruce, which has been planted frequently, and European larch (*Larix decidua* Mill.) have shown promise in the northeast, but these species have not yet been established long enough for a conclusive test. Some plantations of spruce have been destroyed by the white pine weevil (*Pissodes strobi* Peck), a native insect on *Pinus strobus* L. Although eucalyptus in California is sometimes cited as a successful exotic, this species has never fulfilled the purpose for which it was introduced, namely, timber production, because of the unsatisfactory technical qualities of the rapidly grown wood. However, it has become invaluable for shade and ornamental purposes.

Some successful exotics

The foregoing paragraphs present some of the unsatisfactory results of experiments with exotics, but there have also been successes.

The greatest success with exotics in western Europe has been attained with Sitka spruce and Douglas fir in Denmark and Great Britain, both countries having few tree species. Scots pine (*Pinus sylvestris* L.) for example, is the only native commercial conifer in Great Britain which, with its normally mild and moist growing season, is even more favorable to conifers from western Oregon, Washington, and British Columbia than is the climate of their native habitat with long dry summers. Mild wet winters are the rule in both regions.

However, it is significant that Douglas fir, regarded by British foresters generally as the most valuable exotic in the decade beginning in 1920, yielded its place to Sitka spruce during the next decade because of attacks by certain tree pests on Douglas fir and the somewhat unsatisfactory qualities of its coarse, rapidly grown wood. Difficulties with some Sitka spruce plantations, probably largely the result of their establishment on unsuitable sites, had by 1950 given rise to the idea that grand fir (*Abies grandis* Lind.) might be the best conifer for the future.

Red oak (*Quercus borealis* Michx.) has done well so far in Germany, growing on somewhat poorer soils than native oaks. Most of the stands are still young, the only old trees being individuals or small groups. In France there is a stand planted in 1929, which is now reproducing naturally. Red oak is also proving quite valuable in Belgium. Black locust (*Robinia pseudoacacia* L.) so far has been successful in Romania where about 70,000 acres (28,300 ha.) have been planted, and is also said to be doing well in Hungary.

Japanese larch (*Larix leptolepis* Gord.) has done remarkably well in certain localities in southern Germany where the annual precipitation is sufficient. During the dry summer of 1934 the tree was severely damaged in other parts of Germany, so that its usefulness is restricted. It is not yet known whether this species will reproduce naturally in Europe. Within the past few years, a bark lesion caused by *Phomopsis pseudotsugae* Wilson has been found in several localities to be prevalent on, and damaging to, Japanese larch; it does not kill trees but causes large scars on the lower portion of the bole which later reduce the quality of the wood. Infection occurs through wounds during the dormant period of the tree. Since the bark lesion commonly follows artificial pruning, infection can be largely prevented by pruning in May, June, July, when the trees are most active.

The introduction of European larch (*Larix decidua* Mill.) into Great Britain from continental Europe has proven relatively successful, despite the damage to many plantations by canker caused by *Dasyscypha willkommii* (Hart.) Rehm. On good sites the canker is of little consequence.

The most outstanding success with exotics has been obtained in Australia, New Zealand and South Africa, but of course sufficient time has not elapsed for a conclusive test. Monterey, ponderosa, Corsican and maritime pines (*Pinus radiata* D. Don., *P. ponderosa* Laws., *P. laricio* Poir., and *P. pinaster* Sol.) have been the species most widely planted in Australia. Along the east coast in the summer rainfall area, loblolly, longleaf and slash pine (*P. taeda* L., *P. palustris* Mill., and *P. caribaea* More) are most promising; loblolly pine in particular is doing well. Monterey pine, Douglas fir, Corsican, ponderosa and maritime pines have been

most used in New Zealand; and Monterey, maritime and spreading-leaved pines (*P. patula* Schlech. and Cham.) have been doing well in South Africa, the last-named tree coming from Mexico. The species enumerated have been arranged roughly in the order of their importance in each country. The growth of all has been superb and of Monterey pine phenomenal, saw timber commonly being produced in 25 years.

All these trees are native to the north temperate zone where the seasons are diametrically opposed to those in the southern hemisphere. Consequently it has been practically impossible to introduce these species as living plants which, together with a considerable degree of caution against such practice, has resulted in the exclusion of the pathogens occurring on these trees in their native habitat. Monterey pine in particular is affected by a number of fungi and insects in its California home. Monterey and spreading-leaved pines possess an additional advantage in that they are relatively homogenous species, so that the vexing problem of the most suitable strains or races within the species does not obtrude itself, as it does in such variable species as maritime, Corsican and ponderosa pines, and Douglas fir. Although such extensive planting of pure stands is extremely risky, less financial risk is involved than in most artificially created pure stands, because of the short rotations in Australasia and South Africa. Serious as a killing epidemic would be, the loss would still be much smaller than would result from the same damage to stands on a 50-year or higher rotation.

However, conifers introduced from the northern into the southern hemisphere have not remained entirely free from insect pests or pathogens. A wood wasp (*Sirex noctilio* F.), native to Europe, has been established in New Zealand for at least 50 years where it is attacking Monterey pine and other exotic conifers. The insect usually infests suppressed, dying and dead trees, but it is damaging because it hastens the death of trees that could be utilized. It also creates conditions favorable to the breeding of a European bark beetle (*Hylastes ater* Payk.) that is also established in New Zealand, this beetle being particularly injurious to pine seedlings. Not until the wood wasp has reached its possible range distribution, so that the population density can increase rapidly, will the complete extent of the damage this insect is capable of causing be realized. Although as yet unknown on exotic pines in Australia, living Sirex wood wasps in all stages of development were intercepted at several Australian ports during 1951 in nine cargoes of timber, mostly spruce and fir, originating from European ports.

Monterey cypress (*Cupressus macrocarpa* Gord.) in East Africa exemplifies two dangers to an exotic: (1) a native fungus of no consequence becoming pathogenic on an exotic, and (2) a fungus of no significance on the exotic in its native habitat causing loss to the tree in its new environment. *Monochaetia unicornis* (C. and E.) Sacc., found in a harmless form on a native juniper (*Juniperus procera* Hochst.), apparently has become pathogenic on various cypresses, including Monterey, causing severe cankers on young trees in plantations. *Polystictus versicolor*, a wood-destroying fungus relatively world-wide in its distribution but restricted to dead trees in the native habitat of Monterey cypress in California, causes a serious white rot of the wood of living trees in East Africa.

Although exotic conifers have been planted widely in Latin America, notably in Chile, little is known about their development. Several needle cast fungi native to the northern hemisphere have been reported on exotic pines.

Artificial Spread of Pathogens

The spread of pathogens over great distances is almost invariably brought about by man, and as methods of transportation increase in number and in speed, the chance of spreading pathogens likewise increases.

Pathogen carriers are many, but the most important are described in the following pages.

Living plants

Experience has shown that exchange of living plant material is extremely hazardous; for example, the chestnut blight fungus, which came to the United States from Asia on nursery stock, has proved so uncontrollable that one of the most valuable hardwoods will be commercially extinct before long, unless resistant trees can be developed by cross-breeding or selection. Even if successful, it will probably be impossible to restore chestnut to more than a small portion of the forest land it once occupied. The loss of American chestnut (*Castanea dentata* (Marsh.) Borkh.) is the outstanding example in forests of the world of the loss that can be caused by an introduced pathogen, and is an appalling lesson on the danger of introducing nursery stock from other countries. Europe now faces the same future with its valuable native chestnut (*C. sativa* Mill.).

The white pine blister rust fungus was introduced into the United States and Canada on seedlings from German and French nurseries. Although controllable by eradication of *Ribes*, this constitutes a perpetual addition to the cost of growing white or five-needle pines in North America.

The brown-tail moth, *Nygmia phaeorrhoea* (Donov.), a destructive defoliator of various broadleaf trees, was introduced from Europe to the United States on nursery stock. The insect was discovered in 1897. It is now permanently established, and in areas where severe infestation continues year after year has to be controlled by expensive spraying with DDT.

Although not proven, it seems likely that the fungus causing Rhabdocline needle blight of Douglas fir was first introduced into Scotland on seedlings dug from the forest in North America, was then spread over Great Britain by shipments of nursery stock and windborne spores, carried from Great Britain to Germany on nursery stock, and from Germany spread over much of western Europe on nursery stock and also by natural means. The fungus responsible for Adelopus needle blight of Douglas fir probably has followed much the same pattern. Both these pathogens have also been introduced into the eastern United States from their native habitat in the west, presumably on living plants, since the distance seems much too great for wind-borne, rather thin-walled spores to travel and remain viable.

In addition to the above, other pathogens probably carried on living plants into Europe include the Douglas fir aphid (*Chermes cooleyi* Gill.), the silver fir aphid (*Adelges nüsslini* Börner), the cedar needle blight fungus (*Keithia thujina* Durand), and the chestnut blight fungus (*Endothia parasitica* (Murr.) A. and A.). The persimmon wilt fungus (*Cephalosporium diospyri* Crandall), the mimosa wilt fungus (*Fusarium perniciosum* f. *oxysporum* (Hepting) Toole), and several insects have probably been introduced on living plants into the United States.

Cuttings

Cuttings, although not quite such dangerous carriers as complete living plants, are also hazardous. There is no way to sterilize plants or cuttings effectively without severe injury or death to the tissues. With the large amount of poplar breeding and selection that is now underway in Europe, South America and to a lesser degree the United States, resulting in a considerable interchange of poplar cuttings between some countries, there is great danger that destructive poplar diseases may be widely distributed. Recent attempts to sterilize poplar cuttings carrying the organisms causing leaf blotch (*Septotinia populiperda* Waterman and Cash), Septoria canker (*Septoria musiva* Pk.) and Dothichiza canker (*Dothichiza populea* Sacc. and Br.) have not been successful. However, it is not by means of living plants only that pathogens can be spread. Even dried plants can be dangerous. A needle rust of Scots pine (*Pinus sylvestris* L.) was brought into Wisconsin on leaves of sow thistle (*Sonchus asper* (*L.*) Hill.) with imported Norway spruce (*Picea abies* Karst.) from Europe. The rust (*Coleosporium sonchi-arvensis* (Pers.) Lev.) spread to living sow thistle plants and then to planted Scots pines in the immediate vicinity. Fortunately, this needle rust proved of no consequence, but the manner of its introduction is important.

Soil

Pathogens can be carried in soil, so that the movement of living plants is doubly dangerous; a pathogen may be in the plant or in the soil attached to its roots. A nursery in New Hampshire was free from damping-off for many years until transplants were brought in from another nursery. Almost immediately a destructive damping-off fungus appeared and, since the introduced trees were too old to be affected, the fungus was evidently in fragments of soil attached to the roots. The movement of plants from nurseries is particularly likely to result in the spread of soil-inhabiting fungi causing root rots. It is more difficult to detect diseased roots by inspection than diseases of the above-ground portions of plants.

The introduction of soil from another nursery to promote the development of mycorrhiza can result in soil contamination. There had been no damping-off caused by *Cylindrocladium scoparium* Morg. at a nursery in New Jersey until soil was brought from another nursery. From then on the prevalent fungus causing damping-off was *C. scoparium*.

Other means of introducing pathogens

The elm disease fungus (*Ceratostomella ulmi* (Schwarz) Buisman) was introduced into Europe from Asia (presumably its native home) during World War I, probably on basket or crating material; into the United States from Europe on burl logs for furniture veneer manufacture; and into Canada from Europe probably on crating material. Sirex wood wasps have recently been intercepted at Australian ports in timber shipped from Europe.

The gypsy moth (*Porthetria dispar* (L.)), so destructive to broadleaf trees, first appeared in the United States in 1869 when insects which had been brought from Europe for experimental purposes escaped. Although since that time more than a hundred million dollars have been spent to keep the insect under control, the estimated average annual damage resulting from defoliation and consequent loss of growth, and even death of trees, still amounts to one-and-a-half million dollars in the United States.

Although the means by which pathogens can be introduced are so many — for example, insects in the egg stage can be carried on almost anything — as yet there is no definite evidence that any pathogen of consequence on trees, particularly on conifers, has been distributed by seeds. Furthermore, coniferous seeds can be sterilized effectively by chemicals, although some seeds of broadleaved trees are not easily treated.

Pathogens Attacking Poplars

There are pathogens now known, and undoubtedly many more unrecognized, that could be extremely destructive if introduced into other parts of the world. Much work to increase poplar production is now underway, particularly in Europe and to a lesser degree in North and South America, and the possibilities of introducing pathogens destructive to poplars are therefore great indeed, since there is a widespread exchange of cuttings from country to country, and even from continent to continent.

The worst pathogen on poplar, in the experience of the writer, is *Pseudomonas syringae* f. sp. *populea*, also known as *P. rimaefaciens* Koning, causing bacterial canker. Although this bacterium is not yet known outside Europe, it has severely attacked certain North American poplars planted there. Another pathogen native to Europe but which has long since been introduced into the United States and Canada is the fungus *Dothichiza populea* Sacc. and Br. which causes canker. In the United States and Canada it has proved damaging in nurseries and plantations but has not yet appeared in natural stands. Two poplar diseases have recently been noticed in Europe the causes of which are unknown, while the fungus, *Septotinia populiperda*, causing a leaf blotch, although first found in Europe, is also present in the United States.

There are two extremely dangerous fungus pathogens of poplar in the United States and Canada. The first of these is *Septoria musiva* Pk., which causes a leaf spot of little consequence on native species, but produces cankers on native and exotic hybrid poplars so severe

as to destroy entire plantations. The other is *Hypoxylon pruinatum* (Klotsche) Cke. on aspens (*Populus tremuloides* Michx. and *P. grandidentata* Michx.) causing a canker. A mortality of 70 percent has been reported in some stands. Considering the value of aspen (*P. tremula* L.) in Northern Europe, if *H. pruinatum* was introduced it could be catastrophic.

There are also certain pathogens attacking poplar foliage that can be damaging, for example, *Septotinia populiperda* mentioned previously. Melampsora rusts, although worldwide in distribution, are composed of various species, strains, and hybrids which differ according to region. Some poplars are so susceptible to these rusts that they cannot be used for planting. *Taphrina aurea* (Pers.) Fr., causing yellow leaf blister, although widespread also varies greatly in its virulence.

Pathogens Attacking Other Species

The bacterium, *Bacterium salicis* Day, which causes watermark disease of willow, actually a destructive dieback, is so far known only to occur in Europe. It is so damaging to willows in Great Britain that it seems reasonable to suppose that if it were distributed elsewhere in the world, it would cause equal or even greater damage. Another bacterium, *B. savastanoi fraxini* Tub., causes a cankerous gall on European ash (*Fraxinus excelsior* L.). Although this pathogen is known only in Europe, it is potentially dangerous to the United States and Canada since white ash (*F. americana* L.) native to those countries is susceptible, as has been proved by artificial inoculations.

Oaks are the most valuable broadleaved species in the north temperate zone. At present, a fungus, *Endoconidiophora fagacearum* Bretz, better known by the name of its imperfect stage, *Chalara quercina* Henry, is causing a wilt that is killing oaks over an extensive area in the United States and is spreading rapidly. The origin of the fungus is unknown, but since nothing similar has been reported elsewhere, it must be concluded that this fungus is a potential threat to oaks in other parts of the world.

Powdery mildew of oak caused by *Microsphaera alphitoides* Grif. and Maubl., almost certainly introduced from North America where it is native and not damaging, has been extremely injurious to indigenous oaks in Europe for nearly 50 years. In the French Basque region the fungus has caused almost total destruction of native *Quercus toza* Gill. and Bosc. (Parrot 1948). This oak will have to be replaced by red oak (*Q. borealis*) and pin oak (*Q. palustris* Muench.) both from North America and both resistant to powdery mildew. The fungus is potentially dangerous to oaks elsewhere in the world. Since overwintering is by means of fructifications on dead leaves and mycelium in buds it can be easily distributed.

Plantations are more susceptible to pathogens causing root rot than are naturally reproduced stands. Such pathogens can be carried long distances either in plant tissue or in soil. There are two fungi known to cause root rot which are particularly dangerous, because of the great variety of hosts that they attack. *Helicobasidium mompa* Tanaka which occurs in Japan is known to attack 104 species of plants, including broadleaved trees and conifers. The soil-inhabitating fungus *Phymatotrichum omnivorum* (Shear) Duggar, which so far is restricted to the southwestern United States, causes a destructive root rot of both broadleaved trees and conifers. Although this fungus is limited in its distribution apparently by high temperature requirements, there are undoubtedly various places in the world where it might flourish — in southern Europe near the Mediterranean, for example.

The blister rust fungus, *Cronartium ribicola* Fischer, has largely stopped the planting of exotic five-needle pines thoughout Europe and has added considerably to the cost of growing five-needle pines in North America where they are native and valuable commercially, because the removal of *Ribes*, the alternate host of the fungus, is essential to the production of a satisfactory stand. There are other fungi causing blister rusts that seem potentially capable of great damage outside their native habitat. In the Himalayas, *Cronartium himalayense* Bagchee occurs on long-leaved Indian pine (*Pinus roxburghii* Sarg.), the alternate host being species of *Swertia*. Since *Swertia* is found in Europe and North America, this fungus if introduced might cause serious damage to hard pines there. In Europe, *Cronartium asclepiadeum* (Willd.) Fr., also known as *Peridermium pini* (Willd.) Kleb., causes resin top of Scots pine resulting in the deformation and death of many trees. This rust fungus is specially dangerous since no alternate host is needed, and infection can be transmitted from pine to pine. The reaction of other hard pines to it is unknown. Probably the most dangerous of all is *Cronartium harknessii* (Moore) Meinecke commonly occurring on ponderosa pine (*Pinus ponderosa* Laws.) and lodgepole pine (*P. contorta* Loud.) in the western United States and Canada, which causes large globose galls on the trunks and branches. The fungus has found its way to the eastern United States and Canada, where, under the name of the Woodgate gall rust, it has vigorously attacked Scots pine of all ages. Trees are killed or deformed, as many as 18,000 galls having been found on a single tree. If this rust fungus were introduced into Europe losses would be terrific, and the pathogen would be extremely difficult to control since, as stated above, infection occurs directly from pine to pine. Of course some trees are resistant to it, but it would require decades to build up resistant stock. Meanwhile, Scots pine stands would be decimated.

The rust fungus *Melampsora pinitorqua* Rostr. causes twisted shoots of Scots pine in Europe but is unknown elsewhere. However, the alternate stage of this rust is on poplars which occur wherever hard pines grow.

Seemingly, the most dangerous insect if introduced elsewhere would be the nun moth (*Lymantria monacha* L.) which periodically causes heavy defoliation of conifers, particularly Norway spruce (*Picea abies* Karst.) and Scots pine, and to a lesser degree defoliates broadleaved trees. If introduced into the United States, for example, this insect might do as much damage to conifers as the gypsy and brown-tail moths do to broadleaved trees.

The foregoing pathogens are those that are well known in their native habitats and potentially dangerous to trees elsewhere in the world. There are undoubtedly many more obscure or even unknown pathogens that would be capable of causing great damage in new habitats and on tree species unaccustomed to them.

Conclusions

From the foregoing it can be concluded that the vicissitudes to which an exotic is likely to be subjected will at least increase the difficulty and cost of establishing the species in a new habitat, even if the establishment is not precluded entirely. One must be convinced that the introduced tree has some essential advantage over the native species and gives promise of some possibility of successful culture. Then ideally one should proceed on a properly planned, long-term experimental planting program. Early promise must not be accepted as a guarantee for the future, to be followed by extensive planting, because this way lies the possibility of unreasonable losses. In fact, not until the end of the first rotation can a reasonable prediction be made as to the success of an exotic; even this is not conclusive. It is important that all the races in a variable species have the same long-term test, because from the biotic standpoint, varietal or racial differences within a variable species can be greater than differences between species.

Exotics are not all foredoomed to failure, but for every exotic the chance of failure appears to be much greater than the chance of success.

Pope Receives Delegates to FAO Conference

In the course of the Seventh Session of the Conference of FAO, His Holiness The Pope received delegates in audience at the Vatican Palace. In speaking of FAO's work, His Holiness said: "This program, so varied and so extensive, undeniably raises uncommon difficulties. The most delicate, perhaps, as you have indeed perceived, will consist in creating social conditions by virtue of which the workers to whom you will provide aid and direction will take an intelligent interest in their occupation and utilize to the greatest extent the resources placed at their disposal. It is useless, in fact, to send experts to a place for the purpose of instructing in new methods and of perfecting mechanical equipment, if the human conditions in which a man is living prevent him from deriving that fruit from his efforts which he has a right to expect.

To arouse personal interest and initiative, to show that the good of the community is not obtained at the cost of personal good, but rather to its profit, and ensure that it should really be so — all this is surely a capital element of success. In this way, your economic labors will have also an equally decisive social value, which We wish to underline. Hence, in Our care to manifest Our support and to collaborate with you in this enterprise, We recently made Our contribution towards the program extending technical assistance to various countries, especially to the most neglected regions."

H. H. The Pope also mentioned "as a significant example of the cultural inter-relation of your labours, the project, now being put into operation, of increasing paper production, which has been entrusted to you by the Economic and Social Council of the United Nations".

New Pulp Research Center in Italy

On 21 September 1953 a new Pulp Research and Experiment Center was opened at Rome in the presence of the Under-secretary of Industry and Trade. This new establishment, which is one of the many projects being carried out by the *Ente Nazionale per la Cellulosa e per la Carta* (National Institute for Cellulose and Paper), will — as its name implies — study all plants supplying raw materials for pulp and paper. In the beginning, in particular those trees suitable for central and southern Italy will be studied, since the well-known Poplar Experiment Station at Casale Monferrato is already studying and improving poplar cultivation in northern Italy. The activities of the two institutes will of course be co-ordinated.

The setting up of the new establishment is the direct result of the supply difficulties encountered by the pulp and paper industries in 1950-51, when the Ministry of Industry and Trade invited the *Ente* to work out a program for intensifying and expanding its forest and agricultural activities, in order to stimulate a larger output of pulping raw materials. Attention has also been drawn to the need for extending research and experiment in this field at the FAO pulp and paper consultation, which was attended by prominent experts from all over the world.

In Italy, availability of the raw materials most widely used today (spruce, poplar, cane, straw) will never be sufficient to meet requirements, and only the use of new materials on a large scale can remedy the situation. Without underestimating the possibility of higher production through better care and utilization of the softwood forests in the Alps and, on a shorter term basis, through more extensive poplar cultivation in the Po valley, it can still be said that the best opportunities are offered by the planting in central and southern Italy, and in the off-shore islands, of rapidly growing species. Monterey pine, Canary pine, Douglas fir, heat tolerant poplars, and particularly eucalypts, can certainly achieve much in this respect, provided the social, ecological and technical difficulties confronting the planting of trees in central and southern Italy are successfully overcome. The best means to this end are well coordinated experimentation, combined with research on the biological, ecological, cultural and technological characteristics of the species to be raised. This is precisely the object of the newly established center.

For the purpose of accomplishing its hard and far-reaching task, the center has been divided into the following five sections: Biology, Ecology, Cultural Techniques, Protection, and Wood Technology, which will work in close co-operation. Much research will, in fact, have to be carried out jointly by two or more of them.

A. de Philippis, Professor of Silviculture at Florence University, has been appointed Director of the Center, and the supervision of the various sections has been entrusted to other university professors, amongst whom is G. Giordano of Florence, as well as to L. Chianese, the Inspector-General of the *Ente*.

The results of the Center's work will be published at regular intervals.

Reforestation of Paraná Pine

Extracts from a formal report submitted to the Government of Brazil

by L. J. Rogers,
FAO Technical Assistance Officer

Parana pine (*Araucaria angustifolia*) is in the main confined to the southern states of Brazil, the exception being a small area of forest in the State of Missiones, Argentina. It extends over the high plateau country to the west of the Serra do Mar between latitudes 22° S. and 30° S.

The climate ranges from sub-tropical to temperate, although the northern areas, i.e. from 22° S. to 23.5° S., are within the tropics, the altitude at which the tree occurs modifies the climate so that it may be classed as subtropical.

In the northern part of its range this *Araucaria* does not appear below elevations of 800 meters above sea level but towards the southern limits it is found at lower altitudes, although in no place below 500 meters. It grows on a wide variety of soils derived from granites, basalts, diorites, phyllites, sandstones, schists and shales. The amount of plant food available in the soil plus the ability of the soil to retain moisture appear to be of greater importance than texture or depth.

The species extended originally in an almost unbroken belt from the Serra da Mantiqueira in southern Minas Gerais, southwesterly and southerly through the States of São Paulo, Paraná and Santa Catarina into northern Rio Grande do Sul. Today, remnants only of the original forest are found in southern Minas and in the State of São Paulo; areas of virgin forest exist in western Paraná, Santa Catarina and Rio Grande do Sul, but the area of forest that has been totally devastated is considerable. It is realized that the clearing of forest for agricultural purposes is a feature of the development of many countries, but it does seem that the devastation which has occurred in this part of Brazil cannot be justified by this purpose only. Moreover, the present day cut remains large and the life of the remaining stands at the present rate of felling may optimistically be estimated at only 40 years.

Possibilities of Natural Regeneration

As one travels through the forests of Paraná pine from north to south, the differences in their composition are striking.

In northern Paraná, for example, the forest consists of an upper storey of pine, a second storey of rain forest species such as *Cedrela*, *Aspidosperma*, *Nectandra*, *Phoeve perosa*, etc., and a third storey of fairly dense undergrowth of various woody shrubs, with an almost complete absence of small-diameter pine and pine regeneration. Towards southern Paraná, the forest consists in places almost purely of pine of all sizes, with practically complete absence of rain forest species and only light undergrowth. This type of forest is encountered in Santa Catarina, whilst in the higher elevations and higher rainfall areas of Rio Grande do Sul the forest becomes much denser, both pine and rain forest species of large diameter being common, while there is also a good distribution of all diameter classes of pine from regeneration to the biggest sizes.

It seems therefore that the possibility of regenerating the forests in southern Paraná, Santa Catarina and Rio Grande do Sul by natural means is worthy of further investigation. Knowledge of the silvicultural requirements of the species is still insufficient to enable prescriptions to be laid down for the treatment of the forests to secure natural regeneration, but the following points have been noted:

1. *Araucaria angustifolia* is a strong light demander;
2. the rate of growth of shaded seedlings is very slow;
3. most regeneration occurs in groups in openings made by the removal of trees, along roads, or along the edge of the forest, that is, wherever there is ample overhead light;
4. seed is readily eaten by pigs, and large quantities are gathered for food;
5. seed and seedlings are apparently not damaged by grazing cattle;
6. seedlings of 1.5 meters or more in height are severely damaged, and in many cases killed, by horses and donkeys browsing on the bark;
7. seedlings are easily killed by fire, but trees of 40 cm. or more in diameter appear to be fire resistant;
8. as far as can be ascertained, there is a regular and reasonable seed-fall each year throughout the whole range of Paraná pine.

Artificial Regeneration

Despite the fact that in the southern part of the range of Paraná pine it may be possible to regenerate the forests naturally, it is obvious that the bulk of the new forests required will have to be established by artificial regeneration. Some 14,000 hectares have been planted to date by government agencies and private enterprise, but no research work as to the best techniques and methods has been carried out. It has been generally

Figure 1. *Virgin forest of* Araucaria angustifolia *in southern Paraná. This pine is the timber species of the highest economic importance in Brazil, used for timber and pulp. It makes up perhaps one-third of the softwood resources of Latin America. Argentina and Uruguay are established customers for lumber exports and there is a small export to Europe and elsewhere overseas, partly as a result of Brazil's drive to provide a source of softwood material for European reconstruction after the 1939-45 war.*

accepted that the cheapest and best method of establishing plantations is by direct seeding on sites which have been either previously burned, or plowed and cultivated. In the writer's opinion, this is not so.

Although the cost of the actual planting of seed should be less than that when plants are used, experience has shown that expensive preparation of the site is necessary in order to secure early survival and satisfactory growth. Moreover, during the first year of the seedlings' life, the area has to be tended at least four times, whereas if plants were used instead of seed, the first year of the seedlings' life would be spent in a nursery and at least one year's costly tending eliminated. It is difficult to make an accurate comparison between the cost of establishing a plantation by seed and by the use of plants, but the writer has come to the conclusion that the use of plants would result in a lower overall cost by the end of, say, three years from the sowing of seed.

Another reason given for adopting direct seeding is that it is impossible to transplant seedlings of *Araucaria angustifolia* either from seed beds to transplant beds, or from seed beds to plantations. This is stated to be due to the development by the seedling of a very long taproot in relation to the height of the plant above the ground, and the complete absence of lateral roots on the upper section of the taproot. The root system does in fact develop in this way, but this is very similar to the root development of seedlings of *Araucaria cunninghamii* in Australia. It is considered, therefore, that the adoption of a nursery system developed for this species could also be successful in the case of *Araucaria angustifolia*.

Briefly, the nursery system for the production of planting stock of *Araucaria cunninghamii* is as follows: the nurseries use high shade giving about 50 percent light, the beds are 15 meters long by 3 meters wide, and the seed is sown in September in drills 20 centimeters apart; the rate of sowing aims at a stocking of 26 plants per meter of drill. Seventeen months after sowing, the seedlings are root-wrenched or rootpruned to a depth of 15-18 centimeters below ground level and, following wrenching, the seedlings remain in the seed beds until the following July, when they are lifted for culling, grading and tubing. By the end of September the first tubed plants are ready for planting in the plantation.

The object of root-wrenching is to sever the long taproot and encourage the development of laterals. By wrenching the plants *in situ* and by leaving them in the seed beds for a period of five months following the wrenching, very few losses are incurred; a callus forms over the cut taproot and quite a good growth of lateral root is obtained. Seed beds are kept well watered following root-wrenching, and the resulting plant is well-balanced in respect to crown and root and can be tubed with only very minor losses.

In Queensland, it has been found that, with the lower rainfall and the short periodic droughts which occur during the planting out season, plus the following winter and spring drought, the use of tubed stock is essential for satisfactory survival in the field.

Research Needed in Brazil

For experiments in connection with the establishment of plantations it is desirable to have plants of comparable size and crown development, and this is only possible if nursery plants are available, from which to select the stock for the purpose of the experiment.

The most important investigations which need to be tackled in Brazil are, first, to determine whether it is possible to produce satisfactory planting stocks of *Araucaria angustifolia*, and if the production of such stock is possible; second, to ascertain whether more effective and more economical plantations can be established by using such stock than by the present method of direct seeding.[1]

For such investigations care must be exercised in the selection of seed. As has already been said, *Araucaria angustifolia* appears to produce an adequate crop of seed each year, the seed maturing from late April to late May. The male and female cones are borne on separate trees, i.e. the species is dioecious. Generally speaking, the average tree is of reasonably good form, but in certain regions numerous trees may be found

[1] The proposals that follow are intended for application at Hangua and Fernando Pinheiro. If successful in these more difficult areas, it should not be difficult to modify nursery and field techniques for the balance of the Paraná pine region.

with an unusual crown development of what appear to be epicormic shoots; such trees are referred to locally as " Pinhafilhado ". Some authorities consider that it is characteristic of soils of low pH and of young forest; others consider the shoots to be the result of insect or fire damage many years ago. However, it is possible that the branching habit is hereditary and if so, the collection of seed from such trees would be undesirable.

Following collection, the seed should be subjected to a flotation test and infertile seed discarded. The fertile seed should then be sown in mid-May in drills 20 centimeters apart and with 6 seeds per 30 centimeters of drill. It will be necessary to place each seed in the drill so that the long axis of the seed is at right angles to the length of the drill and the seed is all pointing in one direction. Depth of cover should not exceed 2.5 centimeters and soil may be used to cover the seed. Ten beds should be sown, sufficient for approximately 15 hectares of plantation under a spacing of 2 × 2 meters.

From sowing in May until the following February the beds should be kept free of weeds, the space between the drills being cultivated at three-weekly intervals, and watering should be carried out so that the beds are kept moist during the period of germination. Once the seedlings are well-established, waterings may be reduced to two or three per week, each the equivalent of 20 millimeters of rain.

In mid-February the plants should be root-wrenched by means of a well-sharpened spade, so that the roots are cut at a depth of 15 to 18 centimeters below ground level, and care should be taken to disturb the plants as little as possible during the operation. Watering, weeding, cultivating must be continued after root-wrenching as required.

At the beginning of July the plants must be carefully lifted: weak, spindly and unbalanced plants should be discarded and the balance graded and tubed. The tubed plants will need to be kept under the nursery high shades until ready for despatch to the plantation. A period of ten to twelve weeks in the tube should be sufficient to enable the plant to recover from the shock of tubing and to become established.

The use of galvanised iron tubes made from flat sheets of 28 gauge galvanised iron, 20 × 15 centimeters. in size is recommended. The initial cost of such tubes may be high but they have a life of at least 12 years. In Queensland the annual cost per tube is equivalent to approximately .125 of a Brazilian cruzeiro.

Plantation establishment

If it can be demonstrated that the economic production of tubed, root-wrenched, drill-sown nursery stock is possible, then research into the best procedures for the establishment of plantations using tubed stock will be necessary. (In Santa Catarina and Rio Grande do Sul the use of open root, root-wrenched seedlings has possibilities).

An area of 30 hectares of uniform second-growth forest should be selected, where the soil and topography are also uniform, and this area should be divided into two units each of 15 hectares. One unit should be prepared for direct seeding according to current methods (clearing by bulldozer, plowing, harrowing and planting at 2 meters × 50 centimeters, with the object of thinning to 2 meters × 2 meters by the end of the third year), as follows:

April-July 1954: brush and burn forest cover, clear stumps, and dispose of stumps, logs and roots. Plow to a depth of 30 centimeters and harrow.

July 1954: plant 2 meters × 50 centimeters.

July-December 1954: tend as required.

January-December 1955: tend as required and replant if necessary.

January-December 1956: tend as required and thin to 2 meters × 2 meters.

The procedure for the other unit of 15 hectares, to be planted with tubed stock, should be as follows:

May 1954: sow seed in the nursery.

August-September 1955: brush and burn the area.

October 1955: plant with tubed nursery stock at 2 meters × 2 meters.

October-December 1955: tend as required.

January-December 1956: tend as required and refill if necessary.

By December 1956 the seedlings in the first unit will be two years five months old from seed, and those in the second unit two years seven months old from seed. At this stage a comparison can be made between the two areas in respect to stocking and average height of plants and at the end of 1957 the areas could again be compared.

Detailed and accurate costs for all operations on the two units should be kept, so that a full comparison can be made between the two methods of forming plantations. If it is demonstrated that the use of tubed plants is superior to direct seeding, then research can be instituted for the following points.

Site preparation

The most important point to be decided will probably be the period of time which should elapse between the completion of the brushing and the burning of the brushed material.

Planting

(a) *Season of planting.* Experience in Queensland, Australia, has indicated that the area should be planted as soon after the burn as possible and that planting should be completed before 31 December. Planting commences irrespective of weather conditions although if soil conditions are not good, planting proceeds at a reduced rate until they improve. In the case of *Araucaria angustifolia* it is suggested that a season of planting experiments should cover the period October through February. If the ability of *Araucaria angustifolia* to withstand drought is less than that of *A. cunninghamii*, it may be necessary to postpone planting until the rains of November and December have begun.

(b) *Depth of planting.* This is important, as shallow planting has an adverse effect on survival, and plots

should be put out which cover a range of from, say, plants set 5 centimeters too shallow to those planted 5 centimeters too deep.

(c) *Spacing.* The spacing recommended is 2 meters × 2 meters but experiments will be necessary to cover also the following: 1 meter × 1 meter, 1.5 meters × 1.5 meters, 2.5 meters × 2.5 meters, 3 meters × 3 meters, and 3 meters × 2 meters (the rows 3 meters apart with the plants 2 meters apart along the rows). Information obtained from such experiments should cover cost of planting, cost of tending, branch size, natural pruning, form, height and diameter growth, and volume production per unit area for the various spacings. The thinning schedules to be applied will have to be determined later.

Season of refilling

If planting can be begun immediately following the burn, it may be possible to carry out the necessary refilling by the following January-March. Experimental work should cover refilling in these months plus refilling in the months of August, September and October of the following year. Refilling should not be carried out beyond the second year.

Tending

The present method of tending on burnt and brushed areas is to use hoes or knives for the chipping or cutting of the weed growth. This type of work is not effective. The success of tending on rain forest areas depends on frequent and quick removal of undesirable weed growth by grubbing or by hand-pulling, while the weeds are still small. For example, a seedling of *Solanum auriculatum* pulled out by hand when it is not more than 10 centimeters high is finished with, but if it is allowed to grow until it is 90 centimeters high and then chipped off at ground level or cut by a knife, only that portion of the plant above ground has been destroyed and the rootstock will continue to produce shoots for many years, calling for an expenditure of money several times each year during the first few years of the life of the plantation.

The use of a maize cover-crop does not assist materially in controlling weed growth. It may reduce its rate of growth but it does not prevent germination or survival of weeds. It also has an adverse effect on the planted tree as the root competition from a crop of corn is very great.

An experiment using the following treatments is recommended:

1. control — no tending;
2. tending by grubbing and hand pulling;
3. tending by chopping or cutting;
4. maize cover-crop and tending by chopping or cutting.

The information to be secured will cover frequency of tending, cost of tending, height growth of plants and effects of various tendings on weed succession — the control plot will give an indication of the normal weed succession.

Pruning and thinning

The plantations will not be ready for pruning until at least eight years after planting, and for thinning until probably twelve years, so that the experimental work necessary can be determined later.

Frost hollows

Araucaria angustifolia in the adult tree is very frost-resistant but frost in the low-lying sections of plantations in southern Paraná, Santa Catarina and Rio Grande do Sul are recorded which are sufficiently severe to kill seedlings if newly planted, or until about 3 meters high. It is therefore necessary to locate frost hollows, and either plant them with a frost-resistant species or with pine under the protection of a frost-resistant nurse species.

The Need for Reforestation

Since the area of Paraná pine forest that has been devastated is so large, the need for reforestation is obvious. This was acknowledged by the Brazilian authorities as far back as 1940 when the Instituto Nacional do Pinho was set up with, as one of its main objects, reforestation of cut-over areas with *Araucaria*. The Institute began making plantations in 1944, but the area established is still small. Much more needs to be done, even though reforestation is also being carried out by private enterprise, which in addition is undertaking afforestation of large areas of *campo limpo*, the natural treeless grasslands which occur over extensive areas in the Paraná pine region.

There are different opinions as to the origin of these grasslands, some people claiming that they originally carried forest whilst others think that they are remnants of the original climax vegetation of the area and were never at any time forested. The latter, according to scientific authorities, appears to be the more feasible theory — "the *campos* of today represent edaphic relics of a former climate period".

It seems to the writer that, with fire protection, forest would advance into the *campo* although the pioneering species would not be *Araucaria angustifolia* but some of the broadleaved understorey species. Once the latter were established it is possible that stocking with *Araucaria* would occur, but satisfactory growth could not be expected until a suitable forest climate had been developed which would not be a matter of a few years only.

It is for this reason, and not because of any differences which may exist in the chemical and physical composition of the soils, that the writer considers *campo* soils to be incapable of producing site quality 1 or even site quality 2 plantations. Chemical and physical analyses of forest and *campo* soils that have been made do not reveal any outstanding differences between soils; however, an examination of the soil microflora and microfauna would undoubtedly reveal differences.

Nevertheless, the establishment of plantations on *campo*, using methods currently practised, is relatively easy — much easier than planting on forest land, but it is more expensive.

Rehabilitation of Arid Areas in Turkey

Based on a paper submitted to the 11th Congress of the International Union of Forest Research Organizations

by Franz Heske,
Professor at Hamburg and Istanbul Universities

Natural distribution of high forest in Asia Minor is restricted to the coastal areas under the influence of wet sea winds. The interior is, and always has been, a treeless natural steppe where even salt efflorescence occurs as a result of seriously decreased precipitation.

The steppe conditions of the interior are induced by the topography, in that the high mountain ranges frequently, and particularly in the north and the south, run parallel to the coast and so intercept much of the moisture from the sea. This is also reflected in the forest cover on those mountains and its composition. On the windward side, the forest is fresh and essentially humid, while on the leeward side it is markedly dry. This is particularly noticeable in the coastal mountains along the Black Sea.

Transition from the natural woodlands on the coast to the natural steppeland of the interior is gradual. The forest proper is restricted increasingly to the higher altitudes (hill top and ridge) according to the distance from the coast. It thus tends also to come closer to the timberline and meet the limits of alpine vegetation so that the forest is limited to a diminishing space.

Naturally, transition from forest to steppe is not abrupt, but extremely gradual. Drought-tolerant species gain the upper hand, stand density declines and over large areas the forest steppe becomes dominant, with open stands of trees and shrubs singly or in groups, until at length the last stunted outposts of the woods give way to treeless grassland.

This primeval landscape and plant association have, in the course of the long history of the region, been considerably modified by the hand of man.

Uncontrolled land use, particularly in the more heavily populated areas, relentless exploitation of the forest even to the final uprooting of tree stumps, particularly for fuel and charcoal, as well as incessant forest grazing, especially by goats, sheep and camels, have led to widespread deforestation. Wars and constant migrations, as well as heavy shipbuilding needs throughout the centuries, have been conducive to the destruction of the forest. As a result, the wooded area has declined to some 10-11 million hectares, of which only some 3-3 $\frac{1}{2}$ million hectares can be regarded as woodland in the accepted sense of the term. The rest is poor scrub at various stages of degradation. With the enormously rapid increase in population and the ever greater devastation of the forest due to the continuance on an extensive scale of primitive land use practices, it must be reckoned that the forest in Asia Minor may disappear completely within the next 25 or 30 years.

Results of forest destruction

Destruction of the forest has been, generally speaking, catastrophic for the whole region. Intense soil erosion due to uncontrolled runoff and top soil removal by water in the mountains, and wind in the devastated forest steppe, is already a feature of the Asia Minor landscape. As a result of almost ceaseless clearcutting and uprooting in the forest steppe, the original protective windbreak has disappeared; dry continental winds have unrestricted access, with a consequent exceptionally high rate of evaporation and these accentuate considerably the arid character of the area with its already relatively low rainfall. In consequence, there is a rapid fanning-out of the steppe toward the coastal areas; the dessication of the land and its conversion into steppe proceeds apace as a result of the combined force of these destructive factors.

Soil erosion and unimpeded runoff, due to the destruction of mountain forest, have had an adverse effect on the streamflow of the large Anatolian rivers. Catastrophic flood regularly alternates with periods of low water and dry river beds. Fertile valley bottoms are covered over with sterile sand and debris, and millions of tons of the most fertile soil are lost every year.

In view of the increase in population, such a progressive lowering of the production potential must be regarded as quite disastrous. It is also noteworthy that Anatolia, together with many other parts of the Near East with similar conditions, used originally to be very fertile and was known as one of the granaries of the Old World. The present condition of these areas, with the increasing drop in production potential combined with misuse of the land and the poverty and backwardness of large sections of the population, is largely the fault of man.

Economic and social rehabilitation of the Near East presupposes reclamation of those areas degraded by man as an essential prerequisite to more intensive land use. Restoration of the biological-ecological balance is essential if the land is to be properly watered, since thereby runoff and unnecessary evaporation can be reduced over wide areas, and, as a consequence, a maximum part of the rainfall can be made available for plant production for the use of man and beast. In the absence of glaciers and permanent snow fields, the maximum utilization of precipitation is of vital importance. Irrigation works and artificial reservoirs alone cannot solve the problem any more than can the mere utilization of ground water.

Such constructive improvement is not only a decisive element in the fight against hunger and poverty in the

areas in question, but also a matter of international significance in the light of the growing disequilibrium between population increase and food availability throughout the world.

Forestry measures required

The following forestry measures are of outstanding importance in the restoration of the biological-ecological balance:

1. General recognition in principle of the prime importance of the forest as a promoter of well-being as against its importance as a source of raw materials. In areas such as the Near East and Anatolia the indirect benefits of the forest are of major significance.
2. As the destruction of the forest is an automatic result of primitive land use practices and uncontrolled occupation of land, it cannot be remedied merely by legislation. What is required is a plan for the complete change of land use practices supplemented by land settlement arrangements. The growing pressure of the rapidly increasing population and the industrialization trend make this particularly urgent.
3. Drought control by biological means, systematic soil erosion control, the prohibition of nomadic stock raising, steppe-forest regeneration projects and the introduction of intensive soil conservation measures on selected plots of steppeland protected from the wind, are important parts of such a program. This is not a program which can be carried out piecemeal; it requires broadly planned integration of all the essential measures to be taken Integration is necessary because land use reform has a vital impact on the way of life of rural populations and will consequently affect all the major social and economic sectors of national life. Finally, integration is necessary because land use practices must be synchronized with the progress of the country in other fields. This aim can only be achieved by means of a national plan for forest conservation, drought control and land settlement.
4. The purely forestry items of such a national program include: strict forest conservation in all those parts of the country that are important primarily for agriculture from the standpoint of the beneficial effects of their forests; reforestation of denuded true forest land with priority for areas threatened by erosion; systematic reclamation of water-eroded land; systematic planting of shelterbelts in the Anatolian steppe, giving priority to the original forested steppe that has become arid steppe through the destruction of the stands by man; intensification of agriculture in such reclaimed steppeland, with a view to fodder production, the introduction of stall feeding and with it the production of manure, and the resultant lessening of pressure on the forest range. The conversion of the now treeless steppe into windprotected copse land will solve the fuel problem in these parts; and it may also prove possible to burn dried cattle dung instead of using it as manure. In line with this extensive reclamation of the man-made Anatolian steppeland, the internal land settlement measures mentioned above should be introduced to ease population pressure by diverting it to the newly opened-up land.

Action being taken

Such a comprehensive program has been developed in Turkey with the encouragement and support of the Turkish Government. A research institute for the study of forest geography in the Near East and its attendant economic problems has been set up at the University of Istanbul. The institute's main task is the scientific study and devising of forest practices for arid regions. The head of this institute also occupies a chair recently created at the University for the purpose of giving instruction to students in all matters appertaining to the program. Classes and examinations in the field of forest economics have been made compulsory in the University curriculum. Translations of specialized and scientific literature bearing on the Near East are being prepared in Turkish and one widely used language. These are to be published by the Scientific Publications Department of the University of Istanbul's Forestry School. Experimental plots for steppeland afforestation have been laid out in suitable parts of the Anatolian steppe; their main purpose is to help determine the most suitable tree and bush species for planting as windbreaks on the Asia Minor steppe and the best planting techniques. Contacts have already been made and exchange of experience effected with the forest authorities of research institutes of other Near East countries.

Corrigendum: Vol. VII, No. 4, Equipment News, p. 178: the name of the manufacturers of the SFI Cultivator is G. Callin and I. Troeng, SFI, Experimentalfältet, Stockholm, and not, as stated, Pahlen and Persson, Upplands, Väsby.

Commodity Report

Fiberboards

Since a report on fiberboards was last published in Unasylva *in 1950, the industry has shared in the fluctuations which have characterized the forest products market in recent years, but has continued to expand. This expansion may be expected to continue. The possible uses of fiberboard are increasing; its power to compete with other materials shows no sign of diminishing; there are very few areas of the world which do not possess the necessary raw materials to establish a fiberboard industry; the capital required seldom presents a major obstacle; locally available supplies tend to create their own market.*

Though international trade in fiberboard will remain important, its volume relative to that of total world production and consumption will continue to diminish.

Since 1950 the market for forest products generally, and for fiberboards in particular, has fluctuated considerably. The favorable market conditions in that year and in 1951 raised the volume of fiberboard output and trade to unprecedented heights and greatly stimulated further expansion of capacity in all parts of the world. The heavy fall in demand after the boom year 1951 led to a substantial decline in output, particularly in countries where fiberboard production is mainly for export, e.g. in the northern European countries. During 1952 and 1953 fears were expressed in these countries that fiberboard capacity had been over-expanded. In other producing countries, where the industry relies chiefly on domestic demand, the general level of output remained high.

The reasons for the uneven impact of the 1952 recession on the fiberboard industry may be better understood if we trace briefly the source of the industry's development and describe its present world distribution.

Production

The production of fiber building boards, "wallboards", began in the U.S.A. in the early twenties, when the first insulating board factories were set up. The industry grew rapidly until the end of the decade, and continued to expand, though more slowly, in the thirties. The first hardboard (Masonite) manufacturing plants were set up in the U.S.A. at about the same time. Since, however, the patent covered not only the process but the product itself, development in the hardboard field was stifled until the expiry of the patent at the end of the war. In most other countries, only the process was patented and the manufacture of hardboard developed freely alongside that of insulating boards, though for some time the latter remained more important.

Official figures for U.S. wallboard output before the war (1938) give a production of about 100 thousand tons only, whereas private sources suggest that total capacity was much higher, around 700 thousand tons. Actual production therefore probably exceeded the official figure and was nearer to the unofficial figure of capacity just quoted.

During and since the war fiberboard production has increased rapidly in North America and northern Europe, the most spectacular increase taking place in Sweden, where capacity increased nearly five-fold between 1937 and 1953. Elsewhere the growth, though rapid, has been more recent, and aggregate production outside the regions mentioned still accounts for but a small proportion of the world total.

Thus in the peak production year, 1951, the three countries of northern Europe (Finland, Norway and Sweden), Canada and the U.S.A. together produced 1,849 thousand tons or 75 percent of the world total. Northern Europe's share was 527 thousand tons or 21 percent. But these three countries accounted for 275 thousand tons or 72 percent of total world exports in that year. In the recession year, 1952, their exports fell to 166 thousand tons and production was seriously curtailed. Elsewhere in the world, production is almost entirely directed to the domestic market and, with few exceptions, output was maintained and even increased in 1952. In the U.S.A., production rose by 33 thousand tons to 1,185 thousand tons. Nevertheless, there were signs that the rate of growth of demand was slackening, with keen competition between the mills for sales, especially through the development of new and improved qualities. This is especially true of the insulating board industry, which has developed many different kinds of special boards, today accounting for over a quarter of the total output. Most of the recently added wallboard capacity, particularly hardboard, has been built on the west coast. Among the new processes developed by the U.S. industry is one for manufacturing wallboard without water.

An examination of the figures of fiberboard production in different countries and regions of the world in the years 1948 to 1952 (Table 1) reveals the steady development in countries producing primarily for the domestic market and the fluctuations suffered in those countries producing largely for export.

TABLE 1. — PRODUCTION OF FIBER BUILDING BOARDS
(in thousands of metric tons)

Region	1948	1949	1950	1951	1952	Capacity 1953*
Europe	*490*	*580*	*730*	*900*	*750*	*1 200*
Austria	13	18	18	25	20	50
Belgium	18	17	24	32	40	40
Czechoslovakia	25*	25*	30*	30*	30*	30
Denmark	2	2	2	2	2	2
Finland	52	56	79	117	84	150
France	18	30	38	49	56	60
Germany, Western	37	42	77	106	80	130
Germany, Eastern	15*	20*	25*	10*	10*	25
Hungary	2*	2*	2*	10*	10*	10
Ireland	—	—	2	3	7	10
Italy	26	27	38	37	37	40
Norway	39	48	62	81	72	95
Poland	1*	3*	10*	15*	25*	35
Spain	—	—	—	—	—	10
Sweden	196	233	274	329	227	430
Switzerland	9	10	13	13	14	18
United Kingdom	33	40	35	38	33	55
Yugoslavia	3	3	4	7	6	10
U.S.S.R.	*10**	*20**	*50**	*130**	*150**	*160*
North and Central America	*1 330*	*910*	*1 260*	*1 330*	*1 350*	*1 500*
Canada	169	148	141	170	156	200
United States	1 159	761	1 108	1 152	1 185	1 300
Mexico	—	—	10*	10*	10*	12
South America			*20**	*20**	*20**	*25*
Argentina			10*	10*	10*	12
Brazil			10*	10*	10*	12
Africa				*20	*20**	*20*
Union of South Africa				20*	20*	20
Asia	*20*	*15*	*15*	*15*	*15*	*15*
Japan	19	13	13	15	13	15
Pacific Area	*40*	*40*	*50*	*50*	*60*	*85*
Australia	22	27	37	36	42	55
New Zealand	13	13	16	16	18	30
TOTAL...	*1 890*	*1 565*	*2 125*	*2 475*	*2 365*	*3 005*

* Unofficial.

Note: The following figures for production of fiber building boards in 1938 (in 1,000 metric tons) were taken from the ECE/FAO study, *European Timber Statistics, 1913-1950: Europe* 168, Denmark 1, Finland 23, France 6, Germany (Western and Eastern) 8, Italy 2, Norway 3, Sweden 93 Switzerland 6, United Kingdom 26; *U.S.S.R.*, 3; *North and Central America* 642, Canada 42, United States 600, *Total* 813.

A fiberboard plant is much less costly to install than a pulp or paper mill; it is a good deal less exacting in its raw material requirements. Since the product is fairly cheap in relation to its volume, freight costs bear heavily. On general grounds, therefore, one would expect imported fiberboard to experience difficulty in competing with the indigenous product, and international trade in this commodity to form but a small fraction of the total market. Though this may prove true in the long run, it is nevertheless a fact that in many countries hitherto completely dependent on imports the effect of establishing a local fiberboard industry has been to bring about a marked rise in consumption rather than a diminution in imports. In other words, the existence of a local supply evokes an effective demand hitherto latent.

Fiberboard is a relatively new commodity, making rapid technical progress. Its uses multiply and diversify every year, and its full range of applications has by no means been yet exploited. This is probably the reason why there is still an important international trade in fiberboard, in spite of the fact that it is not ideally suited to long-distance trade and that few countries lack the resources to establish industries of their own. This trade is likely to continue in importance for some time yet. Nevertheless, it seems clear that the establishment of new industries will be determined by the expected level of domestic demand, with the possibility of finding export outlets as only a secondary consideration.

Hardboard production during and since the war has expanded much more rapidly than that of insulating board. This general trend is typified by the development in northern Europe, which in 1938 produced 50 thousand tons of hardboard as compared with 69 thousand tons of insulating board; the corresponding figures for 1951 were 292 and 123 thousand tons respectively. Hardboard has a wider field of utilization and there is no doubt that in recent years it has gained much ground at the expense of other wood products, notably plywood.

TRADE

The volume of international trade in fiberboard, though much higher than before the war, has not expanded commensurately with world production. Even in the peak year (1951) total world exports represented only 15 percent of world production. The main trade flow is from northern Europe to the countries of western and central Europe; in addition there is a small intra-regional trade in North America and small quantities pass, mainly from Europe, to South America, Africa and Asia. Reported figures of trade in fiberboard for the years 1948 to 1952 are given in Table 2.

Europe. The three northern countries, as has already been pointed out, account for three-quarters of world exports. Normally they export just over half their production. About three-quarters of their exports are directed to other European countries and the remainder to destinations overseas. The countries of western and central Europe depend on imports for about one-third of their total supplies. Most of European trade in wallboards is thus intra-regional, and when the setback in European demand came in 1952 the northern countries suffered, being unable to increase their exports to other regions.

North America. The wallboard trade is negligible in relation to the region's consumption, and is virtually confined to the small exchange between Canada and the U.S.A. It has tended to fall since 1948.

South America. Until 1950, it depended entirely on imports from Finland and Sweden for its supplies; though industries have now been established in Argentina and Brazil, and others are likely to follow in the near future, the small import from Scandinavia continues.

Union of South Africa. With the establishment of a wallboard industry in 1951 imports into that country have fallen to negligible proportions. All

TABLE 2. — TRADE

(in thousands of metric tons)

Region	1948	1949	1950	1951	1952
I. EXPORTS					
Europe	*140*	*160*	*230*	*340*	*200*
Austria	3	6	6	9	5
Belgium	4	6	8	12	10
Finland	27	31	50	68	44
France	2	4	4	3	2
Germany, Western	1	2	6	26	9
Norway	10	9	14	24	17
Sweden	95	98	138	183	105
North America	*70*	*50*	*30*	*40*	*40*
Canada	41	32	6	20	18
United States	32	21	21	23	22
Oceania	*2*	*1*	*2*	*2*	*4*
Australia	2	1	1	1	1
New Zealand	—	—	1	1	3
TOTAL...	*212*	*211*	*262*	*381*	*244*
II. IMPORTS					
Europe	*100*	*90*	*160*	*210*	*130*
Belgium	8	11	13	13	14
Denmark	7	16	11	16	13
France	3	—	5	9	10
Germany, Western	1	2	3	2	8
Netherlands	26	24	30	31	26
Switzerland	3	1	2	1	1
United Kingdom	49	37	94	131	54
North America	*40*	*60*	*40*	*30*	*40*
Canada	13	43	12	8	11
United States	27	20	25	24	24
South America	*20*	*15*	*15*	*25*	*15*
Argentina	10	11	6	12	4
Brazil	2	2	3	3	5
Venezuela	5	2	3	2	4
Africa	*20*	*10*	*10*	*15*	*15*
Union of South Africa	14	4	2	2	1
Southern Rhodesia	4	7	4	6	8
Asia	*20*	*10*	*15*	*20*	*20*
India	2	2	2	4	2
Israel	1	1	6	4	2
Malaya	1	1	3	5	4
Oceania	*5*	*10*	*10*	*30*	*20*
Australia	—	10	12	24	14
New Zealand	2	1	1	2	4
TOTAL...	*205*	*195*	*250*	*330*	*240*

other countries in Africa still depend entirely on imported supplies and a steadily increasing volume of imports may be expected.

Asia. Outside the "iron curtain", only Japan possesses a wallboard industry, and the other consuming countries in the region are entirely dependent on imports from Europe. Preliminary figures suggest that the region's imports in 1953 will exceed the volume of the previous year, lower supplies from Finland being more than compensated by an increase in impo from Sweden.

Pacific Area. In spite of the steady expansion of wallboard production since the war, imports continued to rise until 1951. In this peak year, 95 percent of the total came from northern Europe. In the following year imports fell to 18 thousand tons, North America's share of the total rising to 20 percent. Both Australia and New Zealand have a small export trade, mainly within the region, and it is quite possible that, as their wallboard production continues to rise, they will export increasing amounts to Asiatic destinations in the coming years.

PRICES

An examination of the course of fiber building board (wallboard) prices over the last 15 years reveals two features: first, they have fluctuated considerably less than have prices of other forest products, and, second, over the period as a whole they have risen much less than the prices of other commodities whose main raw material is wood. Sawn softwood prices, at their peak level in the 1951 boom, reached seven times their 1937 level and were roughly double the 1947-48 level. In marked contrast, wallboard prices at their peak were less than double their pre-war level and less than 50 percent higher than those prevailing in 1947-48. By the middle of 1953, when sawn softwood prices were still about 80 percent higher than in 1947-48, hardboard prices had returned to, or were fractionally below, their level in the earlier year.

The development of prices is set out in Tables 3 and 4, the latter showing changes in the prices of Swedish hard and insulating board between 1937 and 1953, the former comparing changes in Swedish softwood and hardboard prices (Sweden being the largest exporter) with changes in the average c.i.f. import value of wallboard imported into the United Kingdom — the largest importer.

TABLE 3. — DEVELOPMENT OF FIBERBOARD PRICES COMPARED WITH SAWN WOOD PRICES

(1947-48 = 100)

Year	Sawn softwood[1]	Hardboard[2]	Wallboards[3]
1949	99	100	111
1950: 1st half	122	100	108
2nd half	169	100	110
1951: 1st half	200	130	121
2nd half	214	148	138
1952: 1st half	150	148	140
2nd half	174	103	105
1953: 1st half	177	100	108
2nd half	178	95	110

[1] Index of Swedish export prices f.o.b. for 2½ inch × 7 inch n/s redwood battens.
[2] Index of Swedish prices for 1/8 inch hardboards.
[3] Index of the average value, c.i.f. of imported wallboards in the United Kingdom.

Table 4. — Changes in Prices of Fiberboards in Sweden from 1937 to 1953

(in kronor per m²)

Month and year	Hardboard (1/8 in.)	Insulating board (½ in)
March 1937	1.55	1.30
Nov. 1938	1.45	1.20
Feb. 1940	1.45	1.35
June 1941	1.65	1.55
March 1942	1.85	1.75
Aug. 1942	1.85	1.75
Dec. 1943	1.70	1.60
May 1947	1.85	1.75
July 1947	1.70+6½%	1.60+6½%
June 1948	1.85	1.75
Feb. 1951	2.40	2.25
July 1951	2.75	2.60
July 1952	2.45	2.40
July 1953	1.70*	1.60*
Sept. 1953	1.75*	1.65*

* Estimated. Source: *Sågverksägaren*, No. 9, 1953, Hällefornäs, Sweden.

This contrast between the development of wallboard prices and those of other forest products, which accounts for much of the ground wallboard has gained at the expense of plywood and even sawnwood in recent years, arises from two main causes. In the first place, the wallboard industry is a new and developing one, and technological improvement reducing processing costs per unit of output has largely offset the rise in raw material costs. Secondly, raw material costs themselves form a much smaller proportion of total manufacturing costs — about 20-25 percent in Sweden in 1950, for example, as against 60-65 percent for sawn softwood (even assuming that the sawmill could dispose of its waste commercially), and 55-60 percent and 45 percent for unbleached sulphate and bleached sulphite pulp respectively. Thus fluctuations in roundwood prices have affected wallboard prices much less than those of other forest products.

Nevertheless, the wallboard industry was not immune to the effects of the 1950-52 cycle in the timber market. Imports did increase considerably in 1950 and 1951, and there was a marked price rise. Stocks accumulated in the importing countries, and with the relative slowing down of economic activity in the following year, consumption declined. Consumers began to run down their high stocks and the demand for imports fell sharply. Exporters cut their prices to stimulate business and some importing countries introduced higher duties to protect their domestic industries. Not until 1953, when industrial activity, especially building, began to quicken and when stocks had been reduced to more normal levels, did imports begin to revive.

The present indications are that the wallboard industry will continue to strengthen its position as improved qualities and new fields of use steadily reinforce the competitive power of its products. World consumption of fiber building boards (wallboards) after the war, both in total and per head, showed a spectacular increase as compared with the immediate pre-war period.

Consumption

Since 1948, total consumption has continued to rise, though the rate of increase in consumption per head has slowed down considerably. As may be seen from the selected list in Table 5, the growth in consumption in different regions and countries has not been uniform. Consumption per head remains highest in northern Europe (Sweden in 1948 showed the highest figure yet recorded — 24 kilograms per head). Elsewhere, consumption per head, though rising, has nowhere reached the level in the northern countries or even that in North America. Total consumption continues to rise steadily in the U.S.A. as in Canada, but consumption per head has remained fairly steady during recent years.

Table 5. — Estimated Consumption in Selected Countries, 1948 and 1952/53

(in kilograms per head)

Country	1948	1952/53
Sweden	24.0	20.0
Canada	8.0	11.0
United States	8.0	8.0
Finland	4.0	8.0
Australia	2.5	5.0
Switzerland	2.7	3.1
United Kingdom	1.3	2.5
Union of South Africa	1.0	1.7
France	0.5	1.5
U.S.S.R.	0.05	0.8
Argentina	0.6	0.8
Japan	0.2	0.3

Note: Boards made of straw, wood shavings etc. are excluded.

The figures in Table 5 relate only to fiber building boards proper; they exclude other kinds of building boards manufactured from straw, wood shavings, etc. But in several countries the consumption of these types of board is fairly high and is believed to equal that of fiber building boards proper, for example in the Netherlands and Western Germany. If comprehensive figures for these other types of board were available, it is probable that the increase in wallboard consumption recorded in recent years would appear even more striking. It is known, for example, that there has been a substantial rise in the output of chipboard in the last few years. As, with technical progress, board products diversify, the line of demarcation between the traditional fiber building boards (wallboards) and other categories becomes less and less distinct; unless the available statistics become both comprehensive and more precise, it will be increasingly difficult to follow accurately developments in this field.

Though the end uses of wallboard have multiplied rapidly, the building and furniture industries still provide the chief markets. The rise in consumption after the war was linked closely with the rise in housebuilding and repair activity. Hardboards were extensively used for structural purposes in the temporary hous-

ing programs that figured largely in the reconstruction plans of many European countries, and have continued in demand when the emphasis changed to permanent housing. Standards of heat and sound insulation in housing are much higher today than they were before the war and this has increased the demand for insulating board. Wherever house-building has been temporarily restricted, the demand for both hardboard and insulating board has contracted. Increased availabilities of soft sawnwood and plywood in recent years have failed to check the growth in the use of wallboard, and it is clear that its use in building has become a permanent feature.

Hardboards have tended to displace plywood (and, to a lesser extent, sawnwood) in furniture and packaging too. In the latter market its demand is linked to the general level of manufacturing activity and condi by its power to compete with the alternative materia The demand for hardboard in furniture manufacture is less easy to predict, since the level of activity in the furniture industry depends only in part on additions to the stock of houses. A large proportion of the demand for furniture is replacement demand and, furniture being a durable consumption commodity, the rate at which this demand becomes effective depends on variations in personal disposable income.

Though building, furniture and packaging continue to take most of the products of the wallboard industry, new applications for this new commodity are daily being discovered and the next few years may bring marked changes in the end-use pattern of the industry's output.

Fishing Boat Design

A paper for the International Fishing Boat Congress organized last year by FAO in Paris, France, and Miami, U.S.A., reports that European beach fishing boats are normally built of wood with planking of clinker, carvel or seam-batten construction. The advantages of wood are its low cost, favorable strength/weight ratio, elasticity, thermal conductivity and the ease with which it can be formed and assembled by simple and familiar operations. The drawbacks of wood, as a boat-building material, are its hygroscopic, heterogeneous structure and its vulnerability to rot and decay, features that make any strength calculations difficult and uncertain.

To overcome the first of these drawbacks, double-diagonal or triple diagonal construction of panels like skin and bulkheads is one solution, but such panels are difficult to repair. A number of beach lifeboats and naval craft are built according to this method enabling light and strong construction with good results. Another solution, that of laminated wood and plywood panels, is coming into use with the aid of modern types of marine glues.

Boat forms like the fishing dory and hard chine square-sterners, lend themselves favorably to plywood construction, particularly for smaller boats, when the available plywood panels are long enough to omit butt-joints of the planking. This form of construction is naturally not feasible for the larger boats of say Denmark and Portugal, except perhaps for the construction of bulkheads, casings, deckhouses and other smaller items.

In the Netherlands, steel is a popular building material, even for small lifeboats. The properties of this material are so well-known that it is perhaps sufficient to note that the main drawbacks are the corrosion and the high thermal conductivity. For small boats the plating needs to be very thin, a matter of a few millimeters or one-sixteenth of an inch. Such thin shells are soon rusted through and are vulnerable to local deformations, therefore extra thickness of the bottoms seems to be necessary. Composite construction of steel and wood may be feasible if the steel is made to carry all the main strains on the hull and the wood used for planking and deck, i.e. only to keep out the water.

Aluminum is now being used extensively in the building of boats and ships. It is lighter, antimagnetic and, in certain alloys, less corrosive than steel. The welding of aluminum is, however, not so easy as the welding of steel and, therefore, most aluminum structures are riveted. Aluminum beach boats would be more expensive than the present wooden ones, but lighter and stronger and, except for local deformations, more durable; items like tanks, including ballast tanks, may be built into the hull structure. In places like Jutland, where the boats are beached on the bare sand, aluminum hulls should be well worth a trial. Composite aluminum and wood construction is being applied in British boat-building for Royal Naval Motor Minesweepers, about 150 feet (45.72 meters) in length. This mode of construction may be a practical solution for future large beach boats.

In addition to metal hulls, much research and investigation is being done, particularly by the U.S. Navy and Coast Guard, on plastic hulls. The molds in which these boats are made are expensive, and mass production is therefore of primary importance.

The Work of FAO

Special FAO Postage Stamp Issue

FAO is the first of the Specialized Agencies of the United Nations to be honored with a special postage stamp issue by the United Nations Postal Administration. Some of the prize-winning designs are shown here. The 3 cent design was finally selected for two values, 3 cents and 8 cents, and issued on 11 February. Negotiations are now under way for the United Nations Postal Administration to issue a special stamp honoring forestry.

Seventh Session of the FAO Conference

Meeting at Rome in November and December last, the Seventh Session of the Conference of the Food and Agriculture Organization reviewed the work of the Organization during the past two years and examined the program and budget for 1954 and 1955 as submitted to the delegates by the retiring Director-General, Norris E. Dodd.

The Conference was pleased to note the close integration that had been achieved between the Regular Program and the Expanded Technical Assistance Program, both of which had grown to the full limits of the financial means at their disposal. The Organization had moved from a phase in which activities were concerned largely with preliminary investigations and initial planning to action programs. The impact of FAO's work was now producing substantial results that were being felt not only in individual countries but in entire regions.

The initial examination of FAO's activities in the field of forestry was undertaken by a panel of delegates whose findings were then passed on to one of the Commissions of the Conference to be considered in plenary meetings. Delegates from 31 member countries attended the discussions of the Forestry Panel, including:

Argentina	Italy
Australia	Jordan
Belgium	Lebanon
Brazil	Libya
Burma	Netherlands
Canada	Norway
Chile	Pakistan
Denmark	Spain
Egypt	Sweden
Ethiopia	Switzerland
France	Thailand
Haiti	Turkey
India	United Kingdom
Indonesia	United States of America
Iraq	
Israel	Yugoslavia

The International Union of Forest Research Organizations and the Commonwealth Forestry Bureau were represented by observers.

The delegates elected as Chairman of the Panel, Victor Bianchi, Inspector General de Parques Nacionales y Reservas Forestales, Chile, who was also responsible for the form in which the findings of the Panel[1] were ultimately accepted by the full Conference and incorporated into its report.

Review of Forestry Activities and Programs

The Conference was of the opinion that the activities of the Organization in the very broad field of forestry showed an admirable pattern of useful and positive actions throughout the world. A measure of the stimulus given to world forestry by the Organization was provided by the results achieved in recent years by member countries acting concertedly on the international plane and by the marked progress apparent also in many individual countries. The degree of international collaboration enlisted by the Organization was commendable.

Forest Policy and Conservation

The Conference expressed general satisfaction with the work accomplished over the past two years by the regional Forestry Commissions established for Europe, Latin America, and Asia and the Pacific. It endors-

[1] The drafting committee included, in addition to the Chairman, R. Jolain (France), Y.S. Ahmad (Pakistan), W. Plym Forshell (Sweden), Sir H. Beresford Peirse (U.K.) and V.L. Harper (U.S.A.)

ed in principle the reports of these bodies.

It noted that the Asia-Pacific Forestry Commission desired to establish a Sub-Commission on Teak, a proposal supported by the FAO Regional Meeting on Food and Agricultural Programs and Outlook in Asia and the Far East, held at Bangalore, India, in 1953. It requested the Director-General to proceed, in consultation with the Chairman of the Asia-Pacific Forestry Commission, with the establishment of such a body.

The Conference stressed again, as at its Sixth Session, the desirability of participation by the Governments of Canada and the United States of America in the activities of the European Forestry Commission.

The Conference attached importance to the studies proposed by the Director-General in regard to forest land ownership, particularly fragmented ownership of woodlands, as affecting forest policy and management; to forest and grazing-land influences on soil and water conservation; and to forest grazing as a form of land utilization. It noted that these topics were a part of the general work of the Organization in regard to agrarian structures.

The Conference urged the Director-General to support investigations into desert rehabilitation through forestry measures and into the influence of grazing in arid areas, both as a destructive and potential improving force.

The Conference noted with approval that, in accordance with the hope expressed by its Sixth Session, the Director-General was giving greater emphasis to problems of the use and management of forest range and other watershed lands, and also that the subject of forest grazing would receive due attention in the program of the Fourth World Forestry Congress.

It was informed of the setting up of a Technical Panel on Forest Range Management, and that arrangements were contemplated by the Director-General for convening a technical meeting on forest grazing from this Panel in early 1954 and suggested that, after such an initial meeting, it might be advisable to form regional groups to consider local aspects of problems connected with forest range management and forest grazing.

Research and Technology

The Conference emphasized the need for stimulating research in general as a fundamental basis for sound forest policies.

The Conference also particularly urged continuation and extension of the facilities afforded by the Organization for the international exchange of forest seeds and planting material, noting with satisfaction the issuing in 1953 of a first edition of an international seed directory.

Importance was attached to the work proposed by the Director-General in regard to afforestation and reforestation, and the Conference stressed especially the needs of arid zones. Research in silviculture and management, especially in tropical forest types, should be lent full support, and on the utilization side the pulping and other industrial use of tropical and temperate hardwoods and of small-sized timber of any species should be given prominence in research activities in interested member countries. Another line of investigation which deserved support was logging and extraction techniques and the training of forest workers, on which improved forest productivity largely depended.

In stimulating research the Director-General should encourage the establishment of new research institutions where these were obviously needed. A special effort should be made to co-ordinate the work of existing institutions, particularly in reference to work in the field of wood technology and utilization. The Conference commended the Director-General on the issuing of the study entitled *Research in Forestry and Forest Products*, which marked a step towards the proper international co-ordination of research.

The Conference concurred in the recommendation of the Third FAO Regional Meeting on Food and Agricultural Programs and Outlook in the Near East, held at Cairo, Egypt, September 1953, that a school for the training of forest rangers and a forest research center be established in Syria, for the benefit of the whole Near East region. It stressed the importance of decentralizing research work in this region to the maximum extent, by establishing experimental sub-stations and carrying out local studies wherever special conditions called for such action.

The Conference was pleased to learn that studies were now in hand on the protection of plantations, the handling of seed, and on eucalypts for afforestation. They would be followed by further studies on logging equipment and on the selection of species for afforestation programs. It urged the early publication of these studies. It noted that the catalogues of forestry equipment issued by the Organization were amongst the best-selling publications of FAO.

The Conference expressed the hope that the Director-General would aim at even closer collaboration with the International Union of Forest Research Organizations.

Forest Economics

Work in this field had now been organized along four major lines of activity — periodic publication of statistics and commodity reports; co-operation with regional Economic Commissions of the United Nations in Europe, Asia, and Latin America, including the organization of joint conferences and committees; special studies; and finally, co-operation in general in FAO projects relating the production, distribution, and consumption of forest products, in order to ensure the proper consideration of economic problems concerning these commodities.

The Conference, expressing satisfaction with this approach, reviewed the specific projects which were contemplated under each of these four headings for the ensuing two years. It commended the Director-General on the completion of the study *European Timber Trends and Prospects* and the progress made with a world pulp survey (see p. 3 of this issue). As regards the former, the Conference reaffirmed the conclusions reached recently by the European Forestry Commission and the Timber Committee of ECE (*Unasylva* Vol. VII, No. 4), and urged European governments to review their existing forest policies. It invited the Director-General to undertake, as time and staff permitted and in co-operation with the Economic Commissions of the UN, similar studies with regard to Latin America, the Far East and Near East, adjusted to local circumstances and available statistical and factual information.

The Conference considered that forest inventories were a subject that should be given special attention, both in the regular program and in technical assistance, because forest policy as well as many other actions and studies depended to a large degree on the availability of reliable information about forest resources and growth.

Technical Assistance

The Conference held the clear view that the technical assistance work in forestry was of outstanding importance.

It approved of the general priorities that were used by the Organization in making a selection from the many requests received for assistance in forestry and in the implementation of the 1953 program and preparing the 1954 program. First consideration should be given to technical assistance in such basic matters as inventories, legislation, policy, research, and education. Industrial development projects should be undertaken whenever warranted by local conditions.

It recognized that progress in forest production and utilization was often impeded in many countries through lack of trained personnel. A partial remedy for this situation lay in the fellowship program, which on the whole had given good results. A liberalization of the conditions under which fellowships in forestry subjects were granted appeared desirable, though care was required in the selection of candidates and there should be some assurance that a candidate was subsequently employed in the line of work for which he had received training.

Fourth World Forestry Congress

The Conference recorded its gratitude to the Government of India for having undertaken the responsibility of organizing the Fourth World Forestry Congress in December 1954.

It noted with satisfaction that preparations for this gathering were well in hand and that invitations would shortly be distributed by the Government of India; also that, in accordance with the desire expressed by its Sixth Session, a prominent place would be accorded to tropical forestry in the deliberations. Field trips in India would precede the opening of the Congress, and the Conference was pleased to hear that the Government of Pakistan would, after the Congress, arrange field trips both to East and West Pakistan.

Although this Congress was essentially a non-governmental meeting, it would be held under the sponsorship of FAO. The Conference therefore invited Member Governments to give every support to the Government of India in securing full participation by national and non-governmental services, institutes and agencies, and also facilitate the attendance of individuals.

The Conference considered that this Fourth World Forestry Congress should be made the occasion for arousing in member countries greater public interest in forestry, and for bringing to as large a portion as possible of the peoples of all countries a widened consciousness of the value of forest resources and the need, in general, for the conservation of all natural resources.

Near East Forestry Commission

The Conference took note of the report of the Near East Forestry Conference held at Amman, Jordan, in December 1952. It expressed satisfaction with the manner in which the Organization's activities in this region were being intensified, in keeping with directives issued by its earlier sessions.

The Conference concurred in the recommendation of the Amman Conference, which had been endorsed by the Third FAO Regional Meeting on Food and Agricultural Programs and Outlook in the Near East, that a Near East Forestry Commission should be established within the framework of the Organization. The Conference confirmed the belief expressed in the report of its Fifth Session, Washington, 1949, that the work of such Commissions should be adjusted to the needs of each region. Accordingly, it did not wish to lay down formal terms of reference for the new Commission. It adopted the following resolution:

THE CONFERENCE

Noting the desire of Member Governments in the Near East, as expressed in the Report of the Near East Forestry Conference held at Amman, Jordan, 1952, that a Near East Forestry Commission should be established, with a secretariat provided by the Organization's Near East Regional Office;

Decides to establish such a Commission with functions similar to those of existing regional Forestry Commission, under Article VI of the Constitution of the Organization;

Requests the Director-General to arrange, in consultation with Member Governments concerned, a first session of this body.

Joint Sub-Commission on Mediterranean Forestry Problems

The Conference discussed the present status of the Sub-Commission on Mediterranean Problems which had been set up by the European Forestry Commission in 1947. This body was responsible for formulating a broad forest policy for countries of the Mediterranean area, especially in regard to soil conservation, reforestation, and the long-term production of timber. In view of the importance that Member Governments had attached to the work of this body, the Conference felt that it would now be opportune to extend both the responsibility and membership of this Sub-Commission, so that the impact of its work might be more widespread. The new body should be able to draw upon the experience gained in other parts of the world with similar conditions. The Conference accordingly adopted the following resolution:

THE CONFERENCE

Considering the advantages to be gained from a concerted attack upon the forestry problems of countries having a Mediterranean-type climate;

Decides to transform the Sub-Commission on Mediterranean Problems of the European Forestry Commission into a Joint Sub-Commission on Mediterranean Forestry Problems under Article VI of the Constitution of the Organization. Membership of this body would be open to all Member Governments of the Mediterranean basin proper, and active participation by other Member Governments on appropriate technical matters should be invited.

Notes that provision for holding a meeting of such a body in 1954 has been made in the Director-General's Program of Work.

Oxford System of Decimal Classification for Forestry

The Conference was apprised of the fact that the joint FAO/IUFRO Committee on Bibliography had, after five years of intensive effort, been able in September 1953 to submit a definitive English text of the Oxford System of Decimal Classification for Forestry to the Congress of the International Union of Forest Research Organizations held in Rome. This new system, which had been elaborated originally by the Commonwealth Forestry Bureau at Oxford, England, to supersede the earlier "Flury System" had been inanimously approved by the IUFRO Congress.

In connection with this subject, the Conference joined the IUFRO Congress in urging Member Governments to establish national centers for forestry bibliography to co-operate with centers undertaking documentation at the international level. Moreover, each country or language group should establish a permanent committee on forest terminology, charged with the task of defining the meaning and use of its forestry terms and of developing its terminology on precise lines.

The following resolution was adopted:

THE CONFERENCE

Notes with satisfaction the completion by the joint FAO/IUFRO Committee on Bibliography of a definitive English text of the Oxford System of Decimal Classification for Forestry, shortly to be published;

Notes, also, that translations into official languages both of FAO and IUFRO are in hand;

Commends this system of classification for adoption by forestry libraries, institutes and documentation centers in member countries;

Requests the joint FAO/IUFRO Committee on Bibliography to review from time to time the classification as now established and to formulate recommendations for the application and development of the Oxford System, as may appear desirable; also to continue its negotiations to have the new system incorporated into the Universal Decimal Classification.

General Conclusions

The Conference broadly indicated the lines of activity which could profitably receive the greatest emphasis over the next two years, under a blending of both the Regular and Expanded Technical Assistance Programs. It noted that the work which the Director-General proposed to undertake in the field of forestry represented a continuation of activities already started; no new projects were contemplated by the Director-General and the Conference did not itself recommend the initiation of any additional projects.

This did not mean that there were not many recognized problems still remaining to be attacked but work on these would have to be deferred for lack of funds. In fact the Conference noted that the early and simultaneous completion of many of the projects listed in the Program of Work and mentioned in the course of discussions was likely to exceed the capacity of the Organization's staff. The Director-General would obviously give particular priority to projects of the greatest practical significance. Any impairment of the present activities of the Organization in the field of forestry was to be deprecated.

Protection from Avalanches

The recent avalanche disasters in Austria, Italy, and Switzerland make topical the interest of FAO in the prevention and control of avalanches. Protection against avalanches is traditionally committed to foresters in the mountainous countries of Europe and also in other parts of the world, notably in Japan, since it is closely bound up with the correct utilization of high mountain watersheds and, in general, with afforestation.

FAO's European Forestry Commission set up a working group on torrent and avalanche control in 1951.

In the summer of 1952 the group toured the French Alps to see at first hand and discuss the engineering projects and afforestation schemes which had been carried out over the past hundred years by French foresters for checking the damage caused in vital parts of this region by mountain torrents, erosion and avalanches.

Protection against avalanches is one of the more urgent problems in which the group is closely interested. Member countries have nominated experts who are exchanging ideas and information on this problem. An expert is preparing a report which will summarize the experience of European countries, and the FAO secretariat is compiling a bibliography.

The group will hold a second study tour in Switzerland in the summer of 1954 to study on the spot problems of snow and avalanches. Outstanding progress has been made in Switzerland in recent decades and the group will be able to discuss the latest techniques evolved by Swiss foresters for preventing the start of avalanches, for their control and for defence against the damage which they can inflict. The study of the physical characteristics of snow forms an important part of these techniques and is carried on in Switzerland by specialized research stations which will be visited by the working group.

Working Party on Coppice Cutting

Extraction from simple coppice or coppice with standards is of considerable importance for many European countries. For coppice exploitation, however, techniques and methods of work are of necessity very different from those employed in normal felling operations in regular forest stands, and certain specialized tools and types of equipment suitable to the conditions of working in coppice cutting have therefore been evolved.

Whereas forest management authorities, research institutions and manufacturers have devoted much attention to the question of rationalization of working techniques and the testing and perfecting of tools to increase the efficiency of logging work in high forests, this has been done to a much less degree with regard to coppice cutting.

At the second meeting of the Pilot Committee on Logging Techniques of the European Forestry Commission, held at Helsinki in February 1953, several delegates insisted on the importance of these questions, and so a Working Party on Coppice Cutting under the chairmanship of G. Giordano, Italy, was set up.

This Working Party organized a meeting from 19 to 21 October 1953 in the Conservation of Niort (Deux Sèvres), France, which was attended by 7 delegates from Belgium, France, Italy and Switzerland.

It was decided to carry out the practical work in a simple coppice of chestnut (*Castanea sativa*), this type of coppice being of interest to many European countries. The Conservation of Niort collaborated by providing facilities and workers to carry out the various operations in the Forêt domaniale de l'Hermitain.

The delegates were enabled to study the various phases of the felling operations with a view to the planning of a systematic investigation on working methods and techniques in coppice cutting, including time studies. French and Italian axes and billhooks were studied in this connection and French mechanized equipment suitable for coppice cutting, including chain and circular saws for felling and bucking, barking machines etc., was demonstrated.

The meeting aroused much interest among local forest authorities and foresters, many of whom followed the practical work.

The Working Party will present a report to the third meeting of the Pilot Committee on Logging Techniques, in May 1954, containing detailed recommendations for a study on timber extraction from different types of coppice. The aim of such a study will be to make a comparative study of tools, working methods and performance with a view to increasing efficiency, lowering costs of production and improving the conditions of forestry workers.

FORTHCOMING MEETINGS

- It is anticipated that FAO's regional Forestry Commissions will meet as follows: the seventh session of the *European Forestry Commission* at Geneva in the autumn, at which time the *ECE Timber Committee* will also be having its twelfth meeting. The third session of the *Asia-Pacific Forestry Commission* will be held in Japan in May 1955, while the fifth session of the *Latin American Forestry Commission* and the first session of the *Near East Forestry Commission* will also take place in 1955. The *Mediterranean Subcommission* is expected to meet next in Greece in June 1954.

- The third *FAO Conference on Mechanical Wood Technology* takes place at Paris in May this year; the *Fourth World Forestry Congress*, as already announced, opens in India next December, while the eighth session of the full *Conference of FAO*, the governing body of the Organization, is set for Rome in November 1955. The twelfth congress of the *International Union of Forest Research Organizations* is scheduled for 1956 in the United Kingdom.

Equipment Notes

All-purpose Vehicles Manufactured in Europe[1]

Technically, an all-purpose vehicle should have the following features:

1. *The front axle must be convertible into a driving axle* in case of need. Still better results are obtained if there are two driving axles instead of one at the rear, the driving axle being normally the rear axle. The second model, called the " 6 × 6 ", is that adopted in the G.M.C. and in most surplus war vehicles. It has a more evenly distributed load and exerts less pressure on the ground. For the user who is concerned with costs, the " 6 × 6 " has the disadvantage, compared with the " 4 × 4 " of needing four extra tyres, and an axle with its transmissions, universal joints, etc. It follows that the factory price is higher and expenditure for maintenance and repairs heavier. However, for a vehicle to be really suitable for all types of work, its front axle must be a driving axle; then the two axles are always over two distinctly different parts of the terrain. In fact, for peacetime use, the " 4 × 4 " model will usually prove adequate. This system is greatly to be preferred to that of the double rear-driving axle without front-driving axle which, while it allows better load distribution, only has limited advantages as regards travelling over all types of ground.
2. *A double gearbox (with transfer box)* making it possible to gear the car very low on very rough ground: this double gearbox, however, can be dispensed with if the usual gearbox has a sufficient number of speeds, some very low.
3. *High ground clearance*, and stout casing protection for the relatively fragile parts that might be damaged by irregularities of the ground.
4. *Outstanding sturdiness.*
5. *Differential locks* which facilitate travelling over rough ground: this advantage, however, has to be weighed against the risk of stripping the gears if the driver forgets to unlock the differential when he gets back on to the highway. In some cases the system is completed with a center distributor (with a differential self-locking device) so as to distribute the driving force to the axles in proportion to their grip.
6. *Tropicalization*: like other types of equipment employed in tropical forest regions, all-purpose vehicles have to operate under sometimes very high temperatures and more especially very humid conditions. They therefore have to be thoroughly " tropicalized " as regards electrical fittings, coatings, and the parts containing rubber or fabric.
7. *Facilities for attaching winch on the front*: a towing winch is useful for light all-purpose vehicles, frequently required to clear rather difficult obstacles, and also for some logging trucks.

The principal manufacturers of all-purpose vehicles are given below:

French Manufacturers

Berliet

Type GLC. 8. a.

The Berliet Motor Company exhibited, for the first time, at the 1953 Motor Show (1-11 October) the GLC.8.a., a 4-wheel drive vehicle manufactured entirely at its plant.

With a load capacity of 6 tons, the GLC.8.a. has a 5-cylinder, 125 h.p. at 2,000 r.p.m., Berliet-diesel engine.

Its 5-speed gearbox allows 10 combinations, including 5 reduced speeds by a 2-ratio transfer box. The latter has a differential that distributes the driving force to each front wheel through two separate transmissions. In first low gear its speed under load over all ground conditions is 3 km/h.

The GLC.8.a. appears to be specially constructed for forestry operations and for bunching in the bush.

Type GLB.5.HWT

The Berliet GLB.5.HWT chassis is the all-purpose version of the GLB.5. chassis. It can be equipped either with the 4-cylinder, 75 h.p., at 2,200 r.p.m. diesel engine, or with the 4-cylinder, 95 h.p. at 2,800 r.p.m. gasoline engine. This chassis, seen in Figure 1, can be supplied for the " 4 × 4 " or the " 6 × 6 ".

Type " 4 × 4 "

Mounted on 4 driving wheels, this vehicle has a 3-ton load capacity on different types of ground and 4.5 tons on the highway.

An HWT type transfer box controls either the rear axle on the highway, or the two front and rear axles when not in road use.

[1] By Micheline Tuffier, Division des Exploitations Forestières du Centre Technique Forestier Tropical, Nogent-sur-Marne. This is an up-to-date version of an article which appeared in *Bois et Forêts des Tropiques*, No. 29, May-June 1953.

FIGURE 1 – *The Berliet GLB.5.HWT chassis which is used for two truck models – Type "4 × 4" with a load capacity of 3 tons off the highway and 4.5 tons on the highway, and Type "6 × 6 with a 5 ton capacity on all ground conditions.*

It has 4 speeds and can be geared down by the transfer box (that is, a total of 8 speeds forward and 2 reverse). It is noteworthy that, at 1,000 r.p.m. at first normal driving position and with the transfer box in low gear, its speed is 2.6 km/h.

Type "6 × 6"

The standard rear-axle of the GLB.5 is replaced by a rear propelling unit (H.W.T.) consisting of a transfer box (with 2 reduction gear ratios) on which are connected two rear-axles facing each other.

The actual transmission of the driving force to the two rear axles is ensured by a self-locking differential having two gear ratios.

The rear-axles, which are of the non-bearing axle type, also have a 2-ratio reduction gear.

With the original gearbox, the vehicle thus has $4 \times 2 \times 2 = 16$ ratios forward and 4 in reverse.

On account of its 3 driving axles and self-locking differentials, this truck can carry a load of 5 tons on all ground conditions.

BERLIET: Vénissieux (Rhône); H.W.T.: HERWAY-THORN, 48 rue de Malte, Paris.

DELAHAYE

Speedy, suitable for all conditions, very sturdy, the V.L.R. Delahaye was specially constructed for inspecting logging camps, hauling small loads of goods over different kinds of soils, and if needed, for towing.

The chassis is made in two different types:

1. The V.L.R. chassis operating on 24 volts.
2. The V.L.R.C. 12 chassis operating on 12 volts.

Apart from this difference in voltage for the main electrical equipment, the features of the two chassis are identical. Its main features are:

a) engine:	4 cylinder, 3,600 r.p.m., 63 brake horsepower;
b) gearbox:	4 speeds forward and 1 reverse, 1 two–ratio reduction gear giving 8 combinations forward and 2 reverse;
c) front and rear axles:	equipped with a differential lock;
d) dimensions and weights:	overall length: 3.41 m, turning radius: 11.5 m, weight when empty: approx. 1,300 kg., load capacity: 450-500 kg.;
e) performance:	speeds ranging from 3 to 110 km/h.

The transmission unit of the V.L.R., by making the front wheels drive wheels, allows a good grip to be maintained on difficult tracks and with its speed-reducing gear allows travelling over very rough roads.

There is a device for locking the front and rear differentials and so maneuvering out of the roughest stretches.

DELAHAYE, 10 rue du Banquier, Paris 13ème.

FORD

The French Ford Company has put out a type of truck (5-ton load capacity). If desired, it can be fitted with a gasoline or gas-oil engine:

a) gasoline engine:	V8 Ford type 90° cylinders. 100 h.p. at 3,800 r.p.m.
b) gas-oil engine:	"Hercules" type 6-cylinders 95 h.p. at 3,000 r.p.m.

Marmon-Herrington conversion. For over 15 years the "Marmon-Herrington" has been converting the 5-ton Ford truck into an all-wheel drive vehicle, with reduction gear, 8 speeds forward and 2 reverse.

The Marmon-Herrington equipment mainly consists of a front driving axle replacing the original front axle and a transfer box for controlling the two driving axles. It greatly increases the potential of the truck on rough ground.

SOCIÉTÉ FORD, Poissy - S. et O.

Labourier

This firm exhibited at the Lille Fair at the beginning of 1953 a new "6 × 6" all purpose truck, identical in design with the "4 × 4" model (HUD series, truck also equipped with a 90 h.p. Unic-diesel engine).

The following all-purpose vehicles are manufactured by the Labourier firm:

Type "4 × 4"

Model	Engine				Load capacity, in tons
	Type	No. cyl.	H.P.	R.P.M.	
LD.80 F.	diesel	4	80	1 900	7
		6	or 115	1 900	7
LD.F	Unic/diesel	4	80	1 500	15
SUD	Unic/diesel	6	120	1 900	10
HUD	Unic/diesel	4	90	1 950	8
JL.3 NM	diesel	4	80	1 900	6.5

These 5 types of trucks — equipped with a differential locking device — have a gearbox with 5 forward speeds and 1 reverse.

It is to be noted that the LD.80 F truck-tractor can be most useful in tropical countries because of its sturdiness.

Type "6 × 6"

In addition to the vehicle exhibited at the Lille Fair, the Labourier firm makes a 6-wheel drive truck able to haul an 8-ton load, and equipped with a 6-cylinder 130 h.p. Unic engine running at 1,900 r.p.m. It has 5 speeds that can be geared down by the transfer box, namely a total of 10 speeds forward and 2 reverse.

Labourier, Mouchard, Jura.

Latil

The Latil vehicles continue to be as follows:

Tractor, type H.14.TL.10

The Latil tractor, type H.14.TL.10 is a 4-wheel drive vehicle widely adopted by tropical loggers; it is equipped with a 4-cylinder diesel Latil engine checked at 65 h.p., or on request with an 85 h.p. gasoline engine.

Its gearbox has 4 speeds and 2-ratio reduction gears, making 8 forward speeds ranging from 2 to 48 km/h.

It is fitted with 2 differentials, 1 for the front wheels, one for the rear wheels, fitted with a locking device controlled from the driver's seat.

Light transport-tractor, type H.14.Al.TL.10.

Originating from the former type, of which it is a new version, this tractor can not only "pull" but also "carry".

With a load capacity of 3 tons it can be utilized as a light log hauler, being able to haul 5 to 8 tons with a trailer.

It is very useful as a "4 × 4" vehicle for all kinds of haulage on different types of ground.

Vehicle, type H2N.TR.P.Z.

With a load capacity of 18 tons, this vehicle is derived from the 120 h.p. tractor used for heavy farm work and for earthwork.

With 6 driving wheels, including 2 steering wheels, it can be used as a truck or trailer tractor; its engine is a 6-cylinder, 120 h.p. at 1,850 r.p.m. Latil-diesel H2N.

With 4 speeds forward and 1 reverse it has a 2-ratio reduction gear, obtaining for the entire transmission a range of 8 forward speeds, ranging from 3.5 to 44 km/h and 2 reverse speeds.

It has 3 transversal differentials (1 per axle) and 1 longitudinal differential on the transmission, locked from the driver's seat.

Note. – A new transport truck, H.14.Al.TZ type, with a 5-ton load capacity, and 3 driving axles, equipped with the H.14.Al.TL.10 type, 65 h.p. engine, will soon be on the market. Results of its use in tropical countries should prove interesting.

Latil, 8, Quai Galliéni, Suresnes - Seine.

Figure 2 – *The 7 ton "6 × 6" model, one of the three special chassis designed by Panhard Levassor to meet all ground conditions. It is equipped with a 4-cylinder 80 h.p. Panhard-diesel engine.*

Panhard

The Panhard-Levassor firm is now making three types of special chassis, designed for work on all types of ground:

1. "*3.5 ton 4 × 4*"
2. "*7 ton 4 × 4*"
   (7 tons on the highway, 4 tons off the highway).
3. "*10 ton 6 × 6*"
   (10 tons on the highway, 7 tons off the highway).

They are equipped with 4-cylinder 80 h.p. Panhard-diesel engines, ("3.5 ton 4 × 4") and 100 h.p. ("7 ton 4 × 4" and "10 ton 6 × 6").

The front driving axle of the chassis can be ungeared at will, which gives a 4-wheel drive for the "4 × 4" chassis (10 speeds) and a 6-wheel drive (8 counting the dual wheels) for the "6 × 6" chassis with double rear axle (20 speeds). Figure 2 shows "7 ton 6 × 6".

They can be equipped on request with the Eaton double rear-axle combined with the H.W.T. distributor, which quadruples the 5 normal combinations of the gearbox by allowing — with the engine turning at its optimum rate of 2,000 r.p.m. — the reduced speed of 4.25 km/h., useful when climbing on bad ground.

These vehicles can be equipped with gasoline engines and power take-offs. A front winch, especially with the two-speed transfer case, increases its uses.

Société Panhard-Levassor, 19, avenue d'Ivry - Paris 13ème.

Renault

The Régie Nationale des Usines Renault has recently brought out a light commercial 4-wheel drive vehicle, that has a workload of 750 kg. on widely differing ground conditions.

Originating from the Renault 1,400 kg. chassis, this model can be supplied in cab-chassis, van or canvas-top truck. It has a 4-cylinder overhead valve gasoline 52 h.p. engine running at 3,200 r.p.m. It has 8 forward and 2 reverse speeds. A transfer box controls the two front and rear axles; it permits using either the rear axle alone for ordinary highway driving, or the dog-clutch, the front and rear axles simultaneously for cross-country driving. In high gear and on the ordinary highway the vehicle can attain 72 km/h.; this speed is reduced to 48 km/h., by using the transfer box. With a load of 750 kg. it can climb 47 degree slopes.

It is particularly worth noting that the Régie Renault has made for this equipment an open cab with folding windshield and hood.

Prairie Savane and Pick-Up

Renault regularly puts out its colonial series Prairie Savane and Pick-Up, also with four driving wheels, the load capacity being 500 kg. on all terrains and 800 kg. on the highway.

A few months ago, a 750 kg. canvas-top truck, a 750 kg. van, a 500 kg. Prairie and a 500 kg. Pick-Up, all with four driving wheels, covered the circuit trip from Casablanca to Conakry, via Dakar, Bamako, Gao, Bobo-Dioulasso, Abidjan, Kankan, crossing the sands of Mauritania, the Niger, the forest regions of the Ivory Coast and of French Guinea.

The Renault all-purpose vehicles are in general u by the army and the police forces stationed in the territories of the French Union.

Note. – A new Renault all-purpose truck, the 3.5 ton ("4 × 4") will be ready shortly. Originating from the 7-ton chassis, this vehicle has a work-load of 3,500 kg. cross country and 7 tons on the highway. The total grip and pull exerted by the front wheels enable it to go anywhere and to climb 45 degree slopes. It will be equipped with a 6-cylinder gasoline (or diesel) 105 h.p. horizontal engine, running at 2,300 r.p.m.

Régie Nationale des Usines Renault, Billancourt - Seine.

Willeme

The Willème firm is now making the two following all-purpose vehicles:

Type T.T.10 "4 × 4"

a) load capacity:	10 tons;
b) engine:	diesel, 6 cylinders, 175 h.p. 13.54 liters cylinder capacity;
c) gearbox:	8 speeds in all (4-speed gearbox and transfer case);
d) differential lock.	

Type T.T. 15 "6 × 6"

a) load capacity:	15 tons;
b) engine:	diesel, 8 cylinders, 240 h.p. 19 liters cylinder capacity;
c) gearbox:	8 speeds in all (4-speed gearbox and transfer box);
d) differential lock.	

Although the tests made for these two types are very conclusive, the Willème firm did not show these trucks at the recent Motor Show. They will probably be ready for delivery very shortly. Their use in tropical countries should show interesting results.

Willème, 58 rue Noël Pons, Nanterre.

German Manufacturers

Borgward

This company recently exhibited at the Frankfort Motor Show a new version of the "B. 4,000" truck. It can now be made with four driving wheels, the rear axle being a driving axle.

With a load capacity of 4.5 tons, its engine is a 6-cylinder, 4-stroke, 95 h.p., 2,400 r.p.m. diesel.

The other main features are:

a) 5 speeds forward, and reverse;	
b) wheelbase:	3.80 for dump body, 4.20 for platform-rack body;
c) speed:	72 km/h.;
d) tyres:	"Metallic B.20" dual rear.

Carl F. W. Borgward Company, Bremen.

FIGURE 3 – *The type F.60.KF, "4 × 4" all-purpose truck at present in production with Faun-Werke. With an air-cooled, 130 h.p. diesel Deutz engine, it has a load capacity of 8 tons and a speed range of 5 to 48 km/h.*

BUSSING

Two 4-wheel-drive trucks are made by the Bussing Works: the 6,000 type and the 8,000 type.

Their specifications are:

Type "6,000"

a) engine:	diesel, 6 cylinders, 1,800 r.p.m., 120 h.p., water cooling;
b) speeds:	5 forward and one reverse;
c) wheelbase:	4,800 mm.
d) total chassis loading:	7,600 kg.

Type "8,000"

a) engine:	diesel, 6 cylinders, 1,600 r.p.m., 180 h.p., water cooling;
b) speeds:	5 forward and one reverse;
c) wheelbase:	5,340 mm.;
d) total chassis loading:	9,800 kg.

Sufficiently powerful to cope with the toughest working conditions, these trucks seem to combine the properties usually demanded of an all-purpose vehicle.

BUSSING NUTZKRAFTWAGEN GMBH, Braunschweig.

FAUN-WERKE

Type F.60KF, "4 × 4"

The Faun-Werke makes an all-purpose truck with a load capacity of 8 tons, equipped with a 130 h.p. at 1,500 r.p.m., air-cooled diesel Deutz engine and a 6-speed gearbox. See Figure 3.

On rough ground it can travel at speeds ranging from 5 to 48 km/h.

This type of truck can be supplied with a log trailer. For displacement when empty a device permits mounting the bar-wheels on the truck, an important advantage because it prevents unnecessary use of the trailer and hence road wear and tear.

FAUN-WERKE, 53 Hofener Strasse, Nürnberg.

FORD

Type G.398.TA

Some time ago, Ford out put a 4-wheel drive all-purpose truck with a load capacity of 3.5 tons, equipped with a 4-cylinder, 106 h.p., 3,500 r.p.m. gasoline engine.

FORD COMPANY, Köln.

HENSCHEL

Long experience in the manufacture of all-purpose trucks has resulted in types HS.100A, HS.140, and HS.170, now in mass production with Henschel and Son. For type HS.100A see Figure 4.

Type HS.100A

a) engine:	diesel Henschel, type 512 – DI, 6 cylinders, 2,400 r.p.m. 100 h.p.;
b) chassis: (wheelbase)	4,200/5,200 mm.;
c) load capacity:	6,000 kg.

Type HS.115

a) engine:	diesel Henschel, type 522 – DP, 6 cylinders, 2,600 r.p.m., 115 h.p.;
b) chassis: (wheelbase)	3,850 mm.;
c) load capacity:	6,000 kg.

Type HS.140

a) engine:	diesel Henschel, type 513 – DC, 6 cylinders, 140 h.p.
b) chassis: (wheelbase)	3,600/4,200 mm.
d) load capacity:	9,000 kg.

It should be noted that types HS. 100 A and HS. 115 have a 5-speed gear box and transfer box, which give 10 forward speeds. HS. 140 has a 4-ratio gearbox and additional 2-ratio over-drive range, with 8 speeds.

Type HS.170

The Henschel truck construction program has recently been completed by a large transport truck, equipped with a 6-cylinder, 170 h.p. Henschel diesel engine.

By adopting 4 driving wheels and being able to engage or disengage front traction while in motion, the grip-providing weight of these trucks can be utilized to the maximum, so that even on sodden roadways it is practically impossible for the truck to get bogged and immobilized because of inadequate grip.

Henschel and Son has gone especially into the problem of replacing the G.M.C. truck by a vehicle, also all-purpose, having identical properties. They also supply diesel engines adapted to use with the G.M.C.'s and the Diamond's to replace on the latter the gasoline engines whose very high fuel consumption is a serious handicap.

Henschel and Son, GmbH, Henschelstrasse 16, Kassel.

Kaelble

The Carl Kaelble Company exhibited two diesel trucks specially designed for log haulage, at the Frankfort Motor Show.

Type KDV.631

a) load capacity:	14 tons;
b) engine:	diesel, 150 h.p., 1,400 r.p.m., 14.3 liters cylinder capacity;
c) axles:	3, if desired the front a can be a drive axle:
d) wheelbase:	3,500 mm.;
e) speeds:	6, ranging from 5 to 45 km/h

Type KV.612

a) load capacity:	5.7 tons;
b) engine:	diesel, 120 h.p., 1,600 r.p.m., 9.7 liters cylinder capacity;
c) axles:	2, if desired the front axle can be a drive axle:
d) wheelbase:	4,175 mm.;
e) speeds:	6, ranging from 6.6 to 60 km/h.

Carl Kaelble GmbH, Backnang, Postfach 43.

Krupp-Südwerke

Krupp-Südwerke of Essen exhibited at the Frankfort Motor Show, 19-29 March 1953, two types of 4-wheel drive all-purpose trucks.

Type "Drache"

a) load capacity:	8-10 tons;
b) engine:	diesel, equipped with Krupp engine brake, 145 h.p., 1,700 r.p.m., 2-stroke, 4-cylinder;
c) minimum speed:	2.5 km/h.;
d) maximum speed:	on the highway: 60 km/h., off the highway: 35 km/h.;
e) ground clearance front and rear:	650 mm.;
f) fording depth:	1 m.;
g) tyres:	11.00 × 24 (special tread design).

It has a transfer box, permitting 12 forward and 2 reverse speeds, and an air-actuated differential lock.

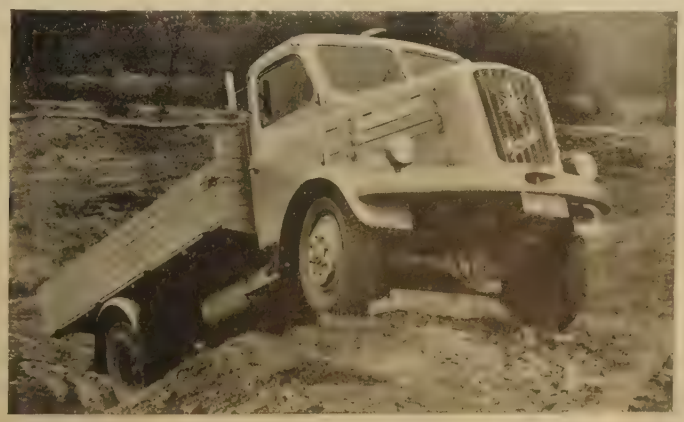

Figure 4 — *Model HS.100A, one o the all-purpose trucks now in production with Henschel and Son. A special feature of this truck is its 5-speed gear box and transfer box giving 10 forward speeds.*

Type " Gigant "

This chassis with 12 forward and 2 reverse speeds is equipped with a 2-stroke, 6-cylinder, 210 h.p. at 1,700 r.p.m. diesel engine. Like the " Drache " it is fitted with a differential lock, a transfer box and the Krupp engine brake.

The " Gigant " type is made in two models, the " AM. 180 " and the " AM. 160 " (dump body 10 m^3 and 9 m^3).

Type AM.180

a) load capacity:	20 tons;
b) speed off the highway:	
(minimum)	5.72 km/h.,
(maximum)	40.5 km/h.;
c) speed on the highway:	
(maximum)	65.0 km/h.;
d) tyres, rear duals, special tread design:	(6 × 24);
e) width:	2,800 mm.;
f) wheelbase:	3,800 mm.

Type " AM.160 "

a) load capacity:	16-18 tons;
b) speed off the highway:	
(minimum)	3.52 km/h.,
(maximum)	31.4 km/h.;
c) speed on the highway:	
(maximum)	56.0 km/h.;
d) tyres, rear duals, special tread design:	(14 × 24);
e) width:	2,500 mm.;
f) wheelbase:	3,800 mm.

Specially designed for use on rough ground, these two trucks would appear to be suitable for use in tropical forests.

KRUPP–SÜDWERKE, Essen.

MAGIRUS-DEUTZ

Type " A.3,500 "

The 4-wheel drive Magirus-Deutz A. 3,500 type truck is equipped with an *air-cooled* 4-cylinder, 90 h.p., 2,300 r.p.m. diesel Deutz engine.

Its other features are:

a) driving axles:	banjo form (front axle steering and ungearable on the highway);
b) turning radius:	approximately 8 m.;
c) wheelbase:	3,700 mm.
d) speeds:	
minimum	approx 3.1 km/h.,
maximum	approx. 88 km/h.;
e) load capacity:	
(on all terrains)	truck: 3,350 kg., truck-dump body: 3,100 kg.

Type " A.6,500 "

Another " 4 × 4 " (type A. 6500) has been perfected by the Magirus-Deutz Co. It has an air-cooled V-8 cylinder, 175 h.p., 2,250 r.p.m. diesel Deutz engine.

Its specifications are:

a) wheelbase:	4,415 mm.;
b) speeds:	
minimum	approx. 3.55 km/h.,
maximum	approx. 73.80 km/h.;
c) work load:	
on the highway:	6,100 kg.,
off the highway:	5,100 kg.

KLOECKNER-HUMBOLDT-DEUTZ A.G., (22 c) Köln-Deutz.

M. A. N.

The M.A.N. Works inform us that two of their trucks, the " MK. 25 " and " MK. 26 " types, of which specifications are given below, can be converted into all-purpose vehicles by adding a front-wheel drive.

Type " MK.25 "

a) engine:	diesel, 120 h.p., 2,000 r.p.m., 6 cylinders;
b) load capacity:	7,400 kg;
c) gearbox:	5 speeds forward, 1 reverse;
d) ground clearance:	
front:	485 mm.,
rear:	335 mm.

Type " MK.26 "

a) engine:	diesel, 130 h.p., 2,000 r.p.m., 6 cylinders;
b) load capacity:	8,650 kg.;
c) gearbox:	6 speeds forward, 1 reverse;
d) ground clearance:	
front:	485 mm.,
rear:	335 mm.

MASCHINEN-FABRIK AUGSBURG NÜRNBERG (M.A.N.) Nürnberg.

MERCEDES BENZ

Tractor, type " Unimog "

The " Unimog ", a 4-wheel drive universal tractor for tropical logging can travel over all types of terrain and climb the steepest slopes. Equipped with a 4-cylinder, 25 h.p. Mercedes Benz diesel engine, it has a very sturdy gearbox (6 speeds ranging from 1 to 50 km/h. and 2 reverse speeds at 2,500 r.p.m.); it is

FIGURE 5 – *The "Constructor 6 × 6" truck manufactured by Scammel Lorries Ltd.*

fitted with a differential locking device on the front and rear axles, and gives an excellent performance even on marshy ground.

The properties demanded of a good forest operations vehicle appear to be combined in the "Unimog" adaptability to all types of terrain; "full-floating" axles and narrow tyres; easy maneuverability, small turning radius; strong drawbar power.

The "Unimog" can serve many uses: as a light all-purpose vehicle or as small tractor (farm, forestry, road work) and for hauling trailers or various machines.

A special forestry rear winch can be attached: 3,500 kg. pull, speed 0.60 m/second, 70 meter cable (diameter 11 mm.).

Type "La. 4,500"

The Daimler Benz A.G. has just launched the La. 4,500 type 4.5 ton multiple use diesel truck with front wheel drive.

It is equipped with a 6-cylinder, 90 h.p., 2,800 r.p.m. diesel engine. The wheelbase, according to whether the chassis is long or short, is 4,200 mm. or 3,600 mm. Off the highway its speed is as high as 50 km/h.

A small tonnage vehicle, the "La. 4,500" can be used either with a 1-axle trailer for light log loads, or as a truck for various haulage.

DAIMLER BENZ A. G., Gaggenau.

English Manufacturers

A.C.V. SALES

A.E.C. "Matador"

This 5-ton 4-wheel drive road tractor, widely used during the second world war, is now employed for log haulage in tropical lumbering, chiefly in the Gold Coast.

Equipped with an A.E.C. 6-cylinder, 95 h.p. diesel engine running at 1,800 r.p.m., this vehicle has the following features:

a) main and auxiliary gearboxes giving 8 forward speeds;

b) front driving and steering axle comprising a 2-step reduction gear;

c) air brakes on the 4 wheels;

d) dimensions and weights:

(*i*) wheelbase:	3,848 mm.;
(*ii*) weight when ready for operating:	approx. 5,800 kg.;
(*iii*) total load:	approx. 11,176 kg.

With a front winch the "Matador" can easily manage difficult terrain.

A. C. V. SALES LIMITED, 49 Berkeley Square, London, W. 1.

AUSTIN MOTOR COMPANY

The Austin Motor Company puts out two "4 × 4" vehicles: the "Austin Champ" and the "K.2.W.A.", their main specifications being:

Type "Austin Champ"

a) load capacity:	2,500 kg.;
b) engine:	Austin A. 90, 79 h.p., 3,750 r.p.m., 4 cylinders;
c) gearbox:	5 speeds.

Type "K.2.W.A."

a) load capacity:	3,000 kg.;
b) engine:	70 h.p., 2,700 r.p.m., 6 cylinders;
c) gearbox:	4 speeds.

Austin Motor Company Limited, Northfields, Birmingham.

Morris Commercial Cars

Morris Commercial Cars make a 4-wheel drive all-purpose vehicle to take a workload of 2,030 kg. and equipped with a 6-cylinder, 72 h.p. gasoline engine running at 2,600 r.p.m.

Fitted with a 4-speed gearbox and a transfer box, its performance is as follows:

a) in high: from 5.4 to 31.7 km/h.

b) in low: from 2.7 to 15.8 km/h.

It is to be noted that a front or rear crab can be attached on request.

Morris Commercial Cars Limited, Cowley, Oxford.

Scammel

This firm has put on the market two types of heavy tonnage all-purpose vehicles, the "Constructor" and the "Mountaineer".

"Constructor" (*"6 × 6"*)

Equipped with a 6-cylinder, 160 h.p. Rolls Royce diesel engine, running at 1,800 r.p.m., and a 6-speed gearbox, the "Constructor" on which all three axles are driving axles, is a powerful vehicle that can carry 30 tons and pull up to 100 tons. See Figure 5.

"Mountaineer" (*"4 × 4"*)

With 4 driving wheels, the "Mountaineer", a less powerful truck but as strong as the "Constructor", can carry 20 tons and pull 60 tons. Its engine, of the Scammel-Meadows type, is a 6-cylinder, 125 h.p. diesel engine with 1,700 r.p.m.

Modern both in design and in construction, these two "heavyweight" vehicles are employed by logging concerns in Tanganyika; they would therefore appear to be suitable for use in other tropical countries.

Scammel Lorries Limited, Watford, Hertfordshire.

Rover Company

"Land-Rover"

The Rover Company manufactures a light all-purpose vehicle already well-known in most tropical countries.

It can be used as an all-purpose or service truck and as a utility vehicle for carrying small loads, and also as a light tractor.

Equipped with a 4-cylinder, 11/58 h.p. engine, the Land-Rover can easily climb 50 degree slopes.

Many extras (belt pulley, crab, arc welding equipment, etc.) can be added for various uses.

For a vehicle of this type the "Land-Rover" operates well on the highway and has the additional advantage of being comfortable.

Rover Company Limited, Solihull, Birmingham.

Universal Power Drives

Among the vehicles manufactured by Universal Power Drives mention may be made of three types of "4 × 4" all-purpose vehicles, which have the following specifications:

Tractor, type "Unipower"

a) engine: 68 h.p., 1,700 r.p.m., 4 cylinders;

b) 5 speeds forward and 1 reverse;

c) can pull up to about 29 tons;

d) equipped with a logging winch and a land anchor.

Tractor, type "Unipower-Hannibal"

a) engine: 85 h.p., 1,700 r.p.m., 5 cylinders;

b) 5 speeds forward and 1 reverse;

c) can pull up to about 25 tons;

d) can be equipped with not only heavy duty logging winch but also a 30 cwt. hoisting crane.

Chassis, type "Unipower Junior"

a) engine: 70 h.p., 2,200 r.p.m., 6 cylinders;

b) 5 speeds forward and 1 reverse;

c) load capacity: 3 tons.

Universal Power Drives Limited, Aintree Road., Perivale, Middlesex.

Italian Manufacturers

Alfa Romeo

Type "1900 Ar-52"

As a light all-purpose vehicle the Alfa Romeo Co. has perfected a "4 × 4", having the following specifications:

a) engine:	70 h.p., 4,400 r.p.m., 4 cylinders;
b) wheelbase:	2,200 mm.;
c) ground clearance:	205 mm.;
d) weight when empty:	1,250 kg.;
e) speed per hour:	105 km.;
f) gearbox:	reduction gear, 4 normal speeds

Alfa Romeo Company, Milano.

Bianchi

Type "Fiumaro"

With 4 driving wheels, a load capacity of approximately 5 tons, the all-purpose "Fiumaro" type truck made at the Bianchi Works is equipped with a 4-cylinder, 80 h.p. diesel engine running at 2,000 r.p.m. It has 6 forward and 2 reverse speeds.

Bianchi, Viale Abruzzi 16, Milano.

Fiat

Type "Campagnola"

The "Campagnola", a light "4 × 4" vehicle, can travel over all kinds of ground and be put to many uses both as a small tractor and as an all-purpose vehicle.

With a load capacity of 500 kg., equipped with a 4-cylinder, 53 h.p. gasoline engine running at 3,700 r.p.m., it has a 4-normal-speed gearbox, 4 low speeds and 2 reverse.

Extra equipment (pulley, etc.) can be added for various uses.

Fiat, Corso IV Novembre 300, Torino.

Lancia

Type "CL. 51"

The Lancia Co. now makes a "4 × 4" all-purpose truck (CL. 51 type).

With a load capacity of 1,800 kg. this truck has a 4-cylinder, 58 h.p. diesel engine running at 3,200 r.p.m.

On rough ground it can go at speeds ranging from 6 to 55 km/h.

The "CL. 51", a transport vehicle, can also be made to tow (TL. 51 type).

Lancia Company, Torino.

Swiss Manufacturers

Berna

The Berna Works has perfected three types of diesel all-purpose vehicles, with the following specifications:

Model	Engine				Load capacity, in kilograms	Wheelbase, in millimeters
	Type	No. of cyl.	h. p.	r. p. m.		
2 UM	R. 2	4	80	1,900	4,000	3,400
4 UM	T. 2	6	125	2,000	5,500	3,400
5 UM	T. 2	6	125	2,000	6,500	3,400

Equipped with a 5-speed gearbox and a 2-ratio transfer box, these vehicles can attain the following speeds (with the engine running at 1,000 r.p.m.):

Model	In low, in km/h.	In high, in km/h.
2 UM	2.1 to 14.2	4.7 to 30.5
4 UM	1.7 to 13.5	3.7 to 29
5 UM	1.8 to 14.3	3.9 to 30.5

Motorwagenfabrik Berna A. G., Olten.

F.B.W.

Type "DX. 50"

The Franz Brozinovic Company has put out a "4×4" to take a work load of 5 tons.

Its engine, of the "DX. 50" type, is a 4-cylinder, 110 h.p. (1,800 r.p.m.) diesel.

Its specifications are:

a) wheelbase: 3,400 mm.;
b) 4-speed gearbox and 2-ratio transfer box;
c) differential locking device;
d) rear winch;
e) performance: in high: from 5 to 29.5 km/h.
in low: from 2.3 to 13.8 km/h.

Brozinovic Company, Wetzikon, Zürich.

Mowag

Type "Gelände"

The Seitz and Ruf AG. Motorwagenfabrik put out an all-purpose light truck, "Gelände" type, with a load capacity of 1,000 kg.

Equipped with a 6-cylinder, 95 h.p. at 3,200 r.p.m., it has a 4-speed gearbox and a 2-ratio transfer box.

At 1,000 r.p.m., its speeds range from 4.2 to 27 km/h in high and from 2.1 to 14 km/h in low.

Seitz und Ruf A. G., Unterseestrasse 63, Kreuzlingen, Thurgau.

Saurer

Among the many vehicles made by the Saurer Company, mention may be made of the three diesel all-purpose types, "2.CM", "4.CM" and "5.CM", with front driving axle.

Model	Engine				Wheelbase, in millimeters	Load capacity, in tons	Performance
	Type	No. of cyl.	h. p.	r. p. m.			
2. CM	CR.2.D.	4	80	1,900	3,400	4	2.1 – 14.2[a] 4.7 – 30.4[b]
4. CM	CT.2.D	6	125	2,000	3,400	5.5	1.7 – 13.5[a] 3.7 – 29 [b]
5. CM	CT.2.D	6	125	2,000	3,400	6.5	1.8 – 14.3[a] 3.9 – 30.5[b]

a) in low b) in high

It should be noted that they have a 5-speed gearbox and a 2-ratio transfer box.

Adolphe Saurer A. G., Aylon.

News of the World

The items appearing here are condensed selections of news thought to be of interest to readers of UNASYLVA. *They are grouped alphabetically by countries under headings currently used by the Forestry Division for reference purposes. FAO assumes no responsibility for statements in news items accepted in good faith from outside contributors.*

General

INDONESIA

• The Union of Foresters began publication of a journal of forestry, *Rimba Indonesia*, in August 1952. Appearing in Dutch with brief summaries of most papers in English, each issue includes one or two original articles; these have dealt, for instance, with forestry and food production in Java — including the *taungya* method used; the rapid and dangerous increase of soil erosion in Java, partly brought about through the destruction of forests during the war; possible forest exploitation of the region of Samarinda which is capable of producing a minimum of 2 cubic meters per hectare annually over an area of 875,000 hectares, which would help to bridge the present gap between Java's consumption of 7.5 million cubic meters a year and the indigenous production of 2 million cubic meters; and the possibilities for large-scale exploitation of *Agathis* forests of Borneo.

Land utilization on Java is much more intensive than that on the other islands of Indonesia, and illegal occupation and felling during the Japanese regime have presented many difficulties to reforestation programs. In 1952, an area of 43,000 hectares was put into cultivation under *taungya*, of which 27,500 hectares were planted with teak. Planned migration continues, aimed at diminishing the pressure of over-population in Java, and an Agrarian Commission has been established to draw up legislation assuring land rights for emigrants moved into other islands.

KOREA

• More than 5.5 million board feet (25,000 m³) of lumber has been purchased in Canada by the U.N. Korean Reconstruction Agency to aid in the rebuilding of Pusan, ravaged by fire last year.

MALAYA

• The *Malayan Forester* has been widely circulated to school children and their teachers in an attempt to instruct the younger generation in the principles and methods of sustained yield, and acquaint them with the objectives and work of the Forest Service. Taking account of this new public for what is essentially a professional journal, senior officers have prepared excellent articles on these two vital aspects of the forester's problem. This significant move in the process of public education will be watched with interest, because, although formal reservation of Malayan forests is far advanced, the perennial conflict between the need for more agricultural land and the permanence of forest reservation nevertheless exists here as elsewhere.

SOUTHERN RHODESIA

• Southern Rhodesia, part of the Central African Federation, is a territory of 150,333 square miles (42.9 million ha.) lying roughly between the 25th and 33rd parallels of east longitude and the 15th and 22nd parallels of south latitude, being thus wholly within the tropics.

A relatively high region, surrounded on all sides by lower country, it has been estimated that more than 21 percent of the total area lies over 4,000 feet (1,200 m.) above sea level: the lowest point is 660 feet (200 m.) and the highest, in the Inyanga Mountains, over 8,500 feet (2,600 m.). There are many other ranges including the Chimanimani Mountains on the eastern border rising to over 7,000 feet (2,100 m.), and — a notable feature of the country — numerous *eiselbergen*, great granite domes rising from flattish surrounding country.

Rainfall is almost entirely confined to the summer season between October and April and varies from a minimum of 11 inches (280 mm.) on the southern border to a maximum of over 100 inches (2,500 mm.) in the Inyanga Mountains in the east. In general the country enjoys bright sunny days and clear nights, with the temperature varying very considerably from day to night. In the cold season, mean minima from 53° to 66° F (11 to 19° C) there is usually warm sunshine during the day, and in the hot season, mean maxima 65° to 84° F (18.5 to 29° C) the nights are generally pleasantly cool. Invasions of cold dry air from the south produce ground frosts.

The country is comparatively well wooded, some 58.9 percent of the total area being more or less covered with trees and shrubs. The vegetation consists for the most part of woodland and grassland, the former being found in two main types, closed forest and open forest or tree veld.

Closed forest is limited in area and is confined to regions of high rainfall or along stream banks; in the former region dominant species such as *Khaya nyasica*, *Lovoa swynnertonii*, and *Trichilia chirindensis* occur. Fringing forest species, which depend largely on altitude, include *Syzygium* spp., *Acacia* spp. *Trichilia emetica* and *Adina microcephala*.

For purposes of the classification of tree veld, altitude, which is the dominant factor, has been taken to indicate the various zones when certain species are more numerous and characteristic. The eight main associations or types are:

(i) *Parinari mobola*, (ii) *Terminalia sericea*, (iii) *Acacia* spp., (iv) *Uapaca kirkiana*, (v) *Brachystegia spiciformis*, (vi) *Baikiaea plurijuga*, (vii) *Brachystegia boehmii*, (viii) *Colophospermum mopane*.

Nos. (i)-(vi) may be considered high veld, (vii) middle veld and (viii) low veld.

Of the total forested area of 88,602 square miles (23 million ha.), 4,795 square miles (1.04 million ha.) are reserved State forest — shortly to be increased by approximately a further 3,400 square miles (881,000 ha.). There are 18,422 square miles (4.8 million ha.) of communal forest, and 30,535 square miles (8 million ha.) consists of unreserved State forest which is for the most part unexploitable: 31,450 square miles (8.1 million ha.) are privately owned and are mostly on farms and cattle ranches.

Up to the end of World War II, forestry activities consisted mainly in the control of exploitation of indigenous forests, though there were two reserves dedicated to afforestation with exotic conifers and eucalypts. Since the war, as a result of experience gained on one of these reserves, there has been large-scale expansion in afforestation with exotic conifers and there are now ten reserves on which active afforestation is being carried out. Mexican pines are the main species used and to those accustomed to rates of growth in the northern hemisphere, increments are phenomenal, a current annual increment of over 700 cubic feet per acre (49 m³ per ha.) being not uncommon, with a mean annual increment of about 250 cubic feet per acre (18 m³ per ha.).

To keep pace with this expanded afforestation, staff has tripled in the last six years and now stands at over 50 officers. An even greater rate of progress can be expected from 1954, when the duties of the Forest Department will be taken over by a Commission to be formed for the purpose. One of the Commission's first tasks must be an overall survey of existing timber resources,

and propaganda on the use of species other than the three currently exploited, namely *Baikiaea plurijuga*, *Pterocarpus angolensis* and *Guibortia colophosperma*.

Private enterprise is also investing considerable sums in afforestation; there is one large company planting *Acacia mollissima* and several smaller companies engaged in planting pines or wattle, or both. Many farmers are also planting eucalypts and other species to meet their own requirements of poles and fuel.

SWEDEN

• Increased appropriations by Parliament have permitted a more comprehensive vocational training of forest owners and workers with both greater scope and a more clearly defined purpose. The Government provides grants for various types of vocational courses arranged by local Forestry Boards, and defrays the total cost of tuition and living allowances to students as well as three-quarters of other expenses. The remainder is raised locally. Students receive free tuition for all courses and a living allowance of 4 kronor per day. In addition, forest workers who attend courses of longer duration are reimbursed for travel expenses incurred and receive compensation for lost earnings at a rate of 5-11 kronor per day.

There are two forms of training in this field, namely, initial youth training and follow-up courses for those already in employment. Under a new school reform, which has been approved in principle by Parliament, the last elementary school year can also be devoted to preliminary vocational training. In rural areas this will usually take the form of training in agriculture and forestry. Most farm schools offer courses in forestry, a few devoting as much as 150 to 400 hours, with emphasis on practical training. Courses combining correspondence and oral instruction are a comparatively recent innovation. Theoretical instruction for about 1,500 students a year is given by correspondence with evening lectures by a forest expert. Practical training is arranged at intervals throughout the term and at a concluding course.

Follow-up courses usually last about one week each. They are intended for forest owners and workers and are limited to a single subject. More comprehensive courses in the techniques of forest work are also arranged, although on a small scale. Lasting for 3-4 weeks, they are intended to train forest workers for more independent and responsible tasks. Forestry Boards arrange longer courses for owners and prospective owners of forest farms.

UNITED STATES OF AMERICA

• Forty years ago the American Bankers Association - a trade organization for the banks of the nation - established an Agricultural Commission as one of the many sub-divisions of the Association, its work being essentially to keep abreast of agricultural problems and to assist member banks in meeting the credit needs of farmers.

Although many banks have actively participated in promoting forestry for some years, it was not until 1949 that a sub-committee on forestry was established as a part of the Agricultural Commission. The first effort of this body was to draw the attention of the State Bankers Associations to the many values involved in forestry programs. A forestry manual for banks has been prepared, showing some of the ways in which a bank may become acquainted with work that needs to be done in preserving timbered lands and developing them to their maximum usefulness. This manual, entitled *Trees and Bank Accounts*, is obtainable from the Agricultural Commission, American Bankers Association, 12 East 36 Street, New York 16, N.Y.

The Commission is fully aware of the important role that credit can play in the development of farm woodlands to their maximum productive capacity. National banks, however, cannot at present make loans on timberlands. It is felt that the removal of this restriction would have a powerful paychological effect on the promotion of forestry and on banks' interest in forestry.

• The U.S. Forest Service has recently issued a revised list of materials to help teach forest conservation at the elementary, junior high school, and senior high school levels; it is entitled *Materials to Help Teach Forest Conservation* (K-28, revised April 1953), obtainable from the U.S. Forest Service, Department of Agriculture, Washington 25, D.C. The list includes material for drawing up curricula; audio-visual aids, such as transcriptions, films, colored posters, charts, and colored maps; bulletins, bookmarks; tree description sheets; teaching outlines; and brief pamphlets.

Fundamental Science

UNITED STATES OF AMERICA

• Halogeton is a poisonous, succulent annual introduced into the western United States before 1934 from the Altai region of central Asia, since when it has spread over about 1 ½ million acres (600 000 ha.) of rangeland in Nevada, Utah, Idaho, California, Wyoming, Montana and Colorado and has caused serious losses of sheep, particularly in Idaho.

Valuable ecological research on the plant was undertaken in 1950 by the University of Idaho and to date various facts have been brought to light affecting future occurrence and control. In all the grazing types studied, halogeton invariably occurred on areas where the native perennial stands of shrubs and gra had been destroyed or badly weakened, prolonged overgrazing being the dominant cause of such destruction. On sites formerly dominated by sagebrush and captured by halogeton, seeding to crested wheatgrass and other grass species indicates that halogeton may be controlled by seeding. On the saline and very dry sites formerly supporting salt-desert shrub vegetation, reseeding is very difficult and, while crested wheatgrass shows some success, it has not been established that, on such sites, it will control halogeton. Thus it is probable at present that it will remain as a permanent resident on such sites. Reseeding, where possible, or improving residual stands of native grasses through management, offers some hope of control.

• During its first five years, the American Society of Range Management reached a total membership of 2,710, of whom 57 percent were technicians, 23 percent ranchers and stockmen, 9 percent professional students, and the balance unclassified. In a recent issue of the *Journal of Range Management* published by the Society, several technical studies are reported.

In Utah a four-year test involving the grazing of cattle at three intensities (light, moderate and heavy grazing) on land reseeded to crested wheatgrass, with grazing in the spring and again in the fall after regrowth, has shown:

1. Acres required per cow-month were 3.1, 2.4 and 1.8 (1.3, 1.0 and 0.7 ha.) respectively for light, moderate and heavy grazing, in contrast to 12 to 15 acres (4.9 to 6.1 ha.) on comparable unseeded range.
2. Average daily weight gains per cow were 3.03, 2.90 and 2.21 lb. (1.4, 1.3 and 1.0 kg.) under the three intensities.
3. Weight gains per cow per acre in the spring were 29, 36 and 35 lb. (32, 40 and 39 kg. per ha.) under the three intensities.
4. Heavily grazed pastures do not always provide enough regrowth for fall grazing.
5. Light grazing allows relatively unpalatable old-growth to accumulate.
6. Fewer new plants are being produced under heavy grazing than under the other two intensities, and present differences may become more pronounced.

A study of the desert grassland of the southwestern U.S.A., including analysis of earlier work, shows that much of this widespread and important formation is not a true climax but is rather a subclimax. Dating of fire scars on adjacent forests shows that, before fire control measures

were introduced, fires had occurred at intervals of from 5 to 12 years, averaging about 7 years apart. Many areas which had a low population of shrubs half a century ago are now, since the advent of effective fire control, being strongly invaded by the more aggressive native shrubs; it therefore seems clear that in the past fire was an important factor in keeping desert grasslands open.

New light on the specific resistance to grazing of various range grasses of Nebraska shows that the grasses can be classified into groups having high and low growing points and high or low ratio of fertile to vegetative stems. Grasses with low growing points and low ratios of flower stalks usually were found to increase on heavily grazed ranges. These two factors have not hitherto been widely recognized as explaining the specific resistance of grasses to grazing.

A four-year study of frost heaving of reseeded grasses and legumes on burned-over chamise brushlands in California has shown that the percentage of loss of seedlings has varied from 0 to over 75 percent; that legumes were affected more severely than grasses; plants on northern exposures were heaved more severely than those on southern exposures; a fine rooted species heaved more severely than a coarse rooted species; strong and well established plants heaved less than younger and less well established plants. Differential frost heaving of brush seedlings was found, and this may account for differences in composition of brush stands on different aspects. Soil mulch greatly reduces frost heaving through moderating both high and low temperatures of the soil surface.

Union of Soviet Socialist Republics

• With the implementation of large afforestation programs in the prairie and semi-prairie regions of the U.S.S.R., there has been some disagreement on the effect of such planting on the ground water regime. It has been claimed that in order to exist these forests must draw upon the ground water, and that the level of ground water is lower under forest than in the open prairie. For this reason it is maintained that there should be no extensive plantations on the prairies as they may reduce the ground waters of the region. Experience at Veliko-Anatol does not seem to bear this out.

Veliko-Anatol, located in the prairie region near the Sea of Azov, is the oldest and the most famous of the forest plantations in the U.S.S.R. Now 110 years old, it was started as the first experimental plantation of the prairies. The treeless area to be planted was transected by a long and broad ravine, and at the upper and lower ends two large ponds were built. So long as the land surrounding the ravine still remained largely treeless, the water in the ponds kept about the same level. As the plantations developed in height and density, it was noticed that the water level in the ponds began to fall until finally they dried up completely. This seemed to be conclusive evidence that the water that previously went to maintain the level of the ponds had been used by the growing trees. But as a matter of fact at the same time there appeared at the bottom of the ravine small springs which increased in number and size. A shallow well half way up the ravine in which the water level was 6 meters below the ground in 1892, gradually filled and since 1947-48 has overflowed in a continuous stream. Another stream also appeared at the lower end of the ravine.

Research from 1948 onwards has proved that while the land surrounding the ravine remained treeless or poorly stocked, the precipitation that fell on the area ran off as surface water and maintained the water level in the ponds. As the land became forested, the surface run-off stopped and this caused the ponds to dry up. The precipitation now intercepted by the forest percolated into the ground to become a subterranean flow which caused springs to occur at the bottom of the ravine; it may eventually even fill the original ponds. Forests in the prairies do not then rob the ground waters and the old popular saying that " Forests beget rivers " seems to have been vindicated once more.

• A biological factor that controls the development of forest stands is the mass and the aggregate surface area of their green leaves. Since 1946 the Volga Forest Institute has been carrying out a study of the amount of foliage (both by weight and area) present in stands of different age-classes of five species, namely aspen, oak, pine, birch and lime. The stands selected for study were pure, even-aged and naturally stocked, and had not previously been subjected to silvicultural operations. Sample areas were selected in stands ranging in age from 5 to 100 years for aspen; 5 to 250 years for oak; 12 to 150 years for pine; 5 to 85 years for birch, and 10 to 80 years for lime. Some 500 trees from the various age classes and species were cut down and their foliage analyzed as to weight (green and air-dry) and surface area — all reduced to a hectare basis.

Although the different species had certain special characteristics, one feature was found common to all: the amount of foliage both by weight and area naturally increases rapidly from the seedling to the sapling stage, then culminates at a certain age, in the case of aspen between 15-20, birch 20-25, oak 20-40, lime 20-30, and pine at 30 years. As the stands emerge from the sapling stage toward fuller maturity, the amount of foliage cover decreases abruptly due to the rapid natural thinning out and mortality of many trees. After a few years, however, this decrease levels out and the rate of leaf production remains stationary despite the continuing mortality of many trees. This state continues until the stands become very old — from 100 to 200 years according to species — when the amount of foliage produced shows a marked decline, although the dying out of the trees in the stand is small. As a result the stand opens up, permits more light to reach the ground and thus conditions favorable to natural regeneration are created.

This knowledge of the relation between the development of the stands and their leaves may serve as a guide in many silvicultural practices such as the time and degree of thinning, intermediate cuttings and provisions for natural regenerations.

Silviculture

United States of America and Canada

• Within the United States in recent years new methods have had to be devised to co-ordinate research work being done or planned on major subjects by many individuals, institutions and business concerns; for as each of these develops its own program, there are inevitably duplications and gaps in the program as a whole which could be avoided.

A comparable problem has obviously existed involving both Canada and the U.S.A., and several recent undertakings are seeking to bring together the professional workers from both countries in fields of mutual interest. These undertakings have certain common characteristics:

1. the large number of individuals employed by industry universities and various agencies of county, state and federal governments, each of which is engaged on fragments or aspects of the same problem;
2. the willingness and even eagerness of workers to come together and report on their own work, present and prospective, and on key problems viewed from their own standpoint;
3. interest in discussing the most promising and profitable directions in which future work is needed;
4. active participation by senior officers of the various institutions and concerns;
5. the general trend to set up special committees with wide representation to further and co-ordinate future work;
6. the opportunity for all workers to keep thoroughly up-to-date with all work under way and planned, to discuss directly with each other objectives, techniques and possible or probable results of research.

Specific ventures of this sort, each having a strong international and interregional flavor, are: the Lake States Forestry Clinic on using Chemical Controls in Forest Management; the Lake States Forest Genetics Conference; the Central International Forest Insect and Disease Conference; and the Forest Soils Symposium.

The Chemical Controls Clinic, though composed of U.S. nationals, has dealt with problems of immediate international interest, and was significant in attaching importance to the ecology and physiology of woody weeds; valuable contributions to its work were also made by experts employed by the large chemical concerns. It has emphasized the advantages of graduate studies in tackling organization problems, and has defined the scope and methods of cooperative projects involving public institutions, schools and universities, and industries.

The Lake States Forest Genetics Conference which included Canadian representation, covered both the work in progress and planned by various agencies in the region, and heard papers on work under way in other forest regions. The Lake States Forest Tree Improvement Committee developed out of the Conference, and it is to be presumed that Canadian workers will continue to take part in this latter undertaking.

The Central International Forest Insect and Disease Conference had a fully balanced representation of both workers and leaders in forest entomology and forest pathology from both Canada and the U.S., and has formed itself into a continuing organization with a simplified statement of objectives. A significant feature of many of the reports was the emphasis on control through silviculture and methods other than direct control, together with a thorough analysis and statement of problems and the status of research on them.

The Forest Soils Symposium, though dealing primarily with the Douglas fir region in the States of Washington and Oregon, clearly will be of significance for the contiguous Douglas fir area of western Canada. Although work on forest soils has been under way in the region for only five years, much progress has been made, and the scope and complexity of the problem have expanded as study has developed. Problems tackled include the possible place of air photography in forest soils surveys, the relation of forest soils to productivity, forest regeneration and silvicultural treatment of forests.

Union of Soviet Socialist Republics

• The ground cover in the forest, whether it is made up of grasses or various kinds of mosses, plays an important part in the life of the forest — especially with regard to its growth and natural regeneration. Some grasses, or even mosses, if they cover only part of the ground or form a loose covering do not harm the forest and at times may be even beneficial. But in many cases mosses, especially the sphagnums and some species of the genus Polytrichum (*Polytrichum commune*) cover the ground solidly. They then intercept and absorb precipitation, prevent water from penetrating the ground, interfere with the passage of gases between the soil and the atmosphere, change the water regime of the soil and create unfavorable conditions for tree growth. When this is the case, they lower the productivity of the forest and if they occur on a cut-over area, they prevent young growth from coming up. The eradication of the moss cover in such cases becomes an essential silvicultural measure.

Experiments in eradicating moss were recently carried on in the Lisinsky Forest in the province of Leningrad.

It is a generally accepted fact that sphagnums do not tolerate lime, and die when sprayed with a solution of calcium carbonate. It is assumed that it is not the calcium that causes their death, but that the reaction with water increases the alkali concentration which results in the death of the cells. The ordinary commercial slaked lime in powdered form was therefore chosen to experiment on the eradication of moss. Applications ranged from 10 to 250 grams per m², with the results shown in the following table:

Results of Applications of Slaked Lime to Mosses

Grams per m²	Effects obtained
10 — 25	Slight injury to sphagnum shoots (30%)
50	Killed 30 — 50%, injured further 40%
100	Killed all sphagnum shoots
Up to 250	Eradicated all moss species

The effect was the same under all conditions; no damage was observed to any other plants. The slaked lime must be applied on to the growing sphagnum shoots. It is the contact of the particles of lime with the growing points of the mosses that causes their death.

Uruguay

• An FAO technical assistance officer advising on afforestation in Uruguay reports that the bulk of the planting to date has been with *Eucalyptus globulus*, and although this species has produced fuel and other small-sized products on a short rotation, there are a number of cases where on reaching the age of 30 years or so the stands have commenced to die. *Eucalyptus globulus* occurs naturally at a latitude of from 40-43° south. It is a species of the cooler parts of Australia with a good winter rainfall, moderate summer temperatures and an absence of hot, dry winds. It reaches its best development on rather heavy soils or good quality loams in sheltered mountain valleys. It would therefore appear to be a species not suitable for Uruguay, and as there are other species of eucalypts more suitable, it is recommended that the planting of *Eucalyptus globulus* be discontinued.

Large areas of coastal sand dunes have been planted with *Pinus pinaster*, which has done exceptionally well, even on raw sands, and it is recommended that it be continued to be used for this purpose. The use of the "Leira" strain of *P. pinaster* should be investigated. Plantings of *Pinus radiata* have been observed on various soil types and it is obvious that this species should be used more extensively in future planting programs.

The use of any species of *Araucaria* is not recommended for wholesale planting, but their use in trial plots is certainly recommended. It is interesting to note that the following species of *Araucaria* can be found in the parks and gardens of Montevideo: *Araucaria angustifolia*, *A. excelsa*, *A. cookii*, *A. cunninghamii*, *A. bidwillii* and *A. araucana*. Of these *A. excelsa*, *A. cunninghamii* and *A. bidwillii* are well worth further trial. Other trees which were noted as growing well in Uruguay are: *Agathis australis*, *Cedrus deodara* and *C. atlantica*, *Cupressus torulosa*, various species of *Casuarina*, *Salix*, *Populus*, *Platanus*, *Ulmus*, *Fraxinus*, *Quercus* and *Abies*.

For a planting program for the production of commercial forests it is recommended that plantings be confined to the following species: *Pinus pinaster*, *P. radiata*, *P. caribbaea* and *P. patula*; *Eucalyptus saligna*, *E. botryoides*, *E. maculata*, *E. paniculata*, *E. teretecornis*, *E. camadulensis*, *E. diversicolor* and *E. siderophloia*.

Good work has already been done on the draining and planting of swamp areas with *Salix* and *Populus* and other deciduous species. The technique of drainage, and the establishment and management of such plantations have been developed to a high level. The continued use of this type of planting as part of the planting program would appear to be desirable.

Logging and Engineering

United States of America

• The National Forest Advisory Council has recently completed a thorough analysis of the access road problem in U.S. National Forests. The study was initiated as a result of questions raised by committees of the Council and by individual firms and organizations of forest producing

inquiries regarding the program and proposals previously developed by the Forest Service.

The study involved field analyses in five of the nine National Forest regions, on many individual National Forests, and on a large number of existing or proposed access road projects. A committee studies particularly the need for, and early development of, a comprehensive access road system; the respective extents to which the work in building such a system should be financed by the Forest Service and by private operators; and methods of Government financing. The main conclusions and recommendations of the Council were that:

1. A complete system of main access roads should be developed on the National Forests during the next few years.
2. Federal construction should make up the backbone of the access road system on the National Forests.
3. Emergency situations should not be allowed to govern long-term policy on access road construction.
4. Federal construction of the key access roads is not a move towards governmental interference.
5. The policy of the Forest Service in the construction of access roads should take into consideration the need for making reasonable provision for all classes of dependent timber operators.
6. Operator construction of access roads should in general be restricted to secondary or branch roads.
7. Co-operative financing of main access roads by private operators and the Government is desirable and in the best interests of both parties when ownership is interspersed or contiguous.
8. Current trends indicate that Federal funds made available for main access road building will be returned promptly in timber sale receipts.
9. The planning and execution of a satisfactory access road program by the Forest Service is not possible without a stable annual authorization and allocation of funds.
10. The minimum amount of Federal funds which will adequately implement the access road program of the Forest Service is 25 million dollars on an annual basis for a minimum period of five years.

Regular and adequate Congressional appropriations are considered most desirable, while the allocation of funds from other departments or agencies as an emergency measure is at times desirable, but is *prima facie* evidence that adequate regular provision for an access road program has not been made.

Union of Soviet Socialist Republics

• The Ministry of Forestry is laying considerable stress on the mechanization of all forest operations, especially those requiring heavy manual labor. Mechanization of logging operations has made great strides in the last 10-12 years, and it has been officially reported that the Ministry now has equipment for mechanically operating 91 percent of timber cutting, 60 percent of skidding and 88 percent of hauling operations. In silviculture, however, mechanization did not begin in earnest until 1949, after the adoption of the plan for "remaking nature" in the autumn of 1948.

Although many machines of all sorts are now available for preparing the soil, for sowing and planting, for cultivation etc., in addition to numerous tractors, scrapers, bulldozers, and graders, only a relatively insignificant part of all silvicultural operations has been mechanized for the country as a whole. The greatest progress has been made in the preparation of the ground for sowing and planting of trees, chiefly in the prairie and semi-prairie regions. In the latter, over 92 percent of the land to be sown or planted to trees is now plowed and harrowed with the aid of tractors; in the forested regions, however, only a little over one-half (56 percent) is being worked with tractors.

The work of sowing and planting is mechanized to a much smaller degree, amounting in the prairie and semi-prairie regions to about 39 percent of the work, and for the country as a whole to some 23 percent. Still less mechanized is the work involved in tending plantations. Only 12 percent of these silvicultural operations is done by machines over the country as a whole, and only a little more — 17 percent — in the prairie and semi-prairie regions, while the work of seed collection remains totally unmechanized.

It was only natural that mechanization of silvicultural operations should have advanced most rapidly in the prairie where the level open country lends itself to the same treatment as agricultural land for which machinery had already been largely developed. In forested regions land to be reforested had often first to be cleared of stumps, for which special tools and machinery were needed; for assisting natural regeneration special disking plows were necessary, as in the case of digging machinery for draining swamps. Much research is now in progress to meet these particular needs, but the complexity of the conditions makes development slow. There are, for instance, 60 types of tree planting machines, of which only very few approach a satisfactory performance. It is, however, the aim of the Ministry of Forestry to mechanize practically all silvicultural operations.

Forest Injuries and Protection

Canada

• A study has been made in the Algoma area of Ontario of the mortality rate of balsam fir attacked by spruce budworm, during and after an outbreak of the budworm.

The sampling was done by the continuous-tally strip method at irregular intervals, changing the tally when a change in tree cover type occurred. Tree cover was classified by percentage species composition based on basal area at breast height, and it was found that the basal area of fir and spruce better expressed the amount of foliage or insect food material than did total stem volume. The principal work was done in localities where mortality of fir was 75 percent.

In such areas, and in most cover types, percentage mortality of fir increased with the basal area of fir per acre, and percentage mortality generally increased with the relative height of fir in the stand. Generally the highest degree of fir mortality occurred in types where the softwood component was mainly fir, spruce or pine, and was low where the component was chiefly cedar or a mixture of species. Where fir was in the intermediate height class, percentage mortality decreased as the proportion of hardwoods increased; where fir was understorey, mortality increased with increased proportions of hardwoods; where fir was codominant, the proportion of hardwoods did not affect mortality. An outbreak may occur where the quantity of fir is as little as three cords per acre (18.5 m^3 per ha.) and vulnerability at low densities may introduce great management difficulties.

United States of America

• In the southeastern United States, special tractor-powered fire line plow have long been used in fire suppression and, in 1952, were used on about 45 percent of the forest fires in this National Forest region. Three different units are used: a line disc plow pulled by a crawler tractor of 20 drawbar horsepower and medium and heavy disc plows pulled by crawler tractors of about 38 drawbar horsepower. Experience indicates that three-man plow units replace from twelve to twenty men with hand tools. The average size of fires has been reduced 82.5 percent in

comparison with hand work, and average cost by 48 percent.

Recent field studies in other forest regions of the U.S.A. indicate that there are several regions, including parts of Arizona and New Mexico as well as states of the Middle West and California, in which the fire line plow can be effectively used. The production rate of this unit is high, averaging three miles (4.8 km.) of completed line an hour over level or rolling country and 1 ½ miles (2.4 km.) an hour in mountain country. The unit is not designed for very steep topography, rocky soils or very heavy cover.

• The effectiveness of herbicidal spraying to control undesirable plants on rangelands depends on distribution of the spray, which may account for apparent discrepancies in the results of different experiments. Thus a satisfactory method for measuring the variation in spray coverage is necessary. Such a method, recently developed in California, involves the use of paper, previously dipped in tannic acid solution which is sensitive to aqueous emulsion sprays containing a small amount of ferric chloride and on which spray patterns develop quickly. Use of this method makes it possible to determine swath width, to compare relative droplet size and distribution of sprays from different types of equipment, and to determine the quantity of 2,4-D actually deposited upon plants.

• The first really severe losses of young sugar and ponderosa pines caused by the mountain pine beetle (*Dendroctonus monticolae*) recently occurred in the Sierra Nevada Mountains, California. The young stands had developed under a residual stand of old timber left after early logging, and were 40 to 70 years old. Greatest losses occurred where the stand density index was high, and highest percentage losses were among intermediate and suppressed pines in contrast to the dominant and codominant trees; however, as infestations gained headway, the more vigorous overstorey trees were also successfully attacked.

Two possible methods of preventing attacks are:

(1) thinning out of the subordinate and more susceptible trees in over-dense stands — a measure which is not now economically self-supporting due to lack of markets for such products;

(2) removal of a large part of the overwood, thereby reducing suppression of the younger stands, which is economically feasible.

It is not yet known to what extent similar attacks may appear elsewhere, but this first case is recognized as a very serious potential threat, particularly to the maintenance of sugar pine, in many Californian forests.

Mensuration and Surveying

Sweden

• The third national forest survey was started in 1953 following a new method. The first and second national surveys were carried out in 1923-29 and 1938-52 respectively, the former as a line survey and the second as a combined line and plot survey; provinces were surveyed one by one, a further survey being made after an interval of 15-20 years.

For the 1953 inventory, results are to be published year by year for the whole country which is divided into five regions, and are to be expressed in cubic meters of standing trees (m^3 sk. = "forest cubic meters") for growing stock, increment and cut. One of the main reasons for introducing this new type of inventory is the need for a reliable statistical method of estimating the annual cut (by registering the stumps of the last cutting season).

The survey will be carried out by a "tract survey system", which may be described briefly as follows: the whole country is divided into approximately 10,000 "tracts". One-tenth of these tracts, regularly spaced, will be surveyed yearly, a broken line of about 5-9 km. being investigated. This line is laid out on the map and covers the four sides of a square. Thus each year about 1,000 tracts will be inventoried together with some 9,000 sample plots on forest land. The total length of the surveyed lines will be about the same as in the second national survey, the lines of which will serve as a basis for the new system, the squares being placed along the previous lines; detailed enumeration will be made very much in the same way as in the second survey.

Forest Management

Japan

• As much as 98.5 percent of the total forest-owners in Japan are small owners holding less than 20 hectares, and most of them are often forced to cut immature stands in order to support themselves and their families. To restrict the cutting of immature stands, the poorer forest-owners need credits from national funds. Under the Agriculture Forestry and Fisheries Loan Law, measures are being taken to grant credits to forest-owners through their Associations on the security of forests placed under certain restrictions. The maximum term of the credits is 25 years and the rate of interest 4 percent per annum. In addition 0.5 to 1 percent commission has to be paid to the Forest Owners' Association and 0.1 to 0.3 percent premium on forest fire insurance.

United States of America

• Competition between deer and sheep for grazing on forest land often gives concern to foresters, farmers and wildlife enthusiasts. A report of four years' study of this problem in central Utah appears in the *Journal of Wildlife Management*. Most of the 10,000 acres (4,000 ha.) kept under observation had been overgrazed in the past and was in a more or less depleted condition.

Deer grazed over the entire area except for rocky cliffs and ledges; sheep used only 80 percent of the area. On summer range, forbs provided 71 percent of the deer forage, browse 22 percent and grasses and sedges 7 percent; summer sheep forage consisted of 37 percent forbs, 28 percent browse and 35 percent grasses and sedges. On spring range, grasses although scarce, made up the largest part of both deer and sheep diets; browse and grass together provided 88 percent of the forage and there was great similarity in choice of species.

In their autumn grazing, sheep selected the same forage species that were subsequently chosen by deer in their winter grazing. Where winter range was used in common by deer and sheep, it was again apparent that their diets were much alike.

The similarity of deer and sheep diets causes management conflicts wherever the supply of preferred species is inadequate to satisfy the requirements of both animals. Even where there is an adequate forage supply, farmers contend that sheep numbers could be increased if part of the deer population was removed, and foresters make the reverse claim. Conflict is less on spring range which is used at different times and during different stages of vegetative growth than on summer range which is used at the same time and for a longer period.

Industry and Trade

British West Indies

• Sawnwood is the most valuable export of the Bahamas. Other islands of the British West Indies and Cuba are the principal purchasers, and the United Kingdom the main buyer of pitprops. The chief sources of supply of sawn wood are Abaco and Grand Bahama, but the latter is by far the more important source.

Chile

• The 20 million U.S. dollar loan granted by the International Bank for Reconstruction and Development to the Cia. Manufacturera de Papeles y Cartones, guaranteed by a mortgage and the Chilean Development Corporation, represesents the biggest amount ever signed for in Santiago.

The company will invest the loan in the installation of a newsprint mill in Concepción and a cellulose plant in Bio-Bio. The FAO Forestry Mission has been closely concerned with certain aspects of this development.

FINLAND

• A committee appointed by the Finnish Government in 1953 to investigate costs of production in the timber industry reported that the cost of producing newsprint was 28,291 Finnish marks per ton when the export price was 27,000 marks f.o.b. and the inland price 23,500 marks per ton. The cost of production of kraft paper was 39,604 marks per ton, excluding cost of shipping to harbor, when the export price was 33,250 marks f.o.b. Kraft pulp cost only 19,081 Finnish marks in Sweden against 24,862 marks in Finland, and the total cost of production of kraft paper in Sweden was only 29,643 Finnish marks. The committee did not analyze the causes of this situation.

The average price for sawn wood in the 1949-50 felling season was 77.1 Finnish marks per cubic foot (2,722 marks per m³) as compared with 135 marks (4,767 per m³) in 1953. Against this rise of more than 70 percent, wages had increased by over 60 percent since the first half of 1950.

The Agricultural Producers' Central Association had already pointed out that the price of standing timber in the 1952-53 felling season was only 11 times greater than in 1937-38, while wages were 20 times higher. They claimed that a farmer in central Finland had to sell 42.4 cubic meters of spruce pulpwood in order to buy a mowing machine for which he paid the equivalent of only 32.4 cubic meters of wood in 1938; he had to pay the equivalent of 195.8 cubic meters for a threshing machine against 116.2 cubic meters in 1938.

The Association also claimed that the average price for standing timber was 75 Finnish marks per cubic foot (2,648 per m³) which represented only 17,700 marks or 38 percent of the current total production cost of 46,553 marks per standard of sawn timber; in 1937-38, standing timber represented 65 percent of the total cost. As regards sulphite pulp, standing timber represented only 16.5 percent of the cost as compared with 37 percent in 1937-38. On the other hand, wages represented 44 percent of the cost of sawn timber and 53 percent of sulphite pulp. The pulp mills claimed that even if the standing timber cost nothing, this would not make good their losses.

UNITED KINGDOM

• In connection with the Government's decision to abolish controls on timber, the following statement was issued by the Chairman of the Timber Development Association:

"The Government's long awaited decision to abolish all controls on the consumption of softwood, hardwood, plywood and veneers will be welcomed by all users of wood.

Now, for the first time since 1939, timber and plywood are free to compete on level terms with other materials, and the consumer has once more freedom of choice — the only reliable assurance we can have that materials will be used for the purposes for which they are best suited.

Considerable technical advances affecting the use of timber have been made in recent years, and the Government's decision now presents industry with the opportunity of making full use of the research and development work which has been undertaken. There can be no doubt that these developments will lead to greater efficiency, lower costs and increased productivity."

Forest Products and their Utilization

FRANCE

• A new combination insecticide, fungicide and anti-splitting agent for the treatment of logs, particularly in the tropics, and marketed as Cryptogil DC 6, has been developed in France and tested extensively in Africa. The agent may be applied by brush or spray at the rate of about ½ pound per square yard (0.3 kg. per m²) of log surface immediately or very promptly after felling and log making. All logs except those with very thin, smooth, tight barks should be debarked before treatment, and it is important that the whole log be covered. It is claimed that the treatment lasts even during prolonged heavy rains, and may be applied during light rains; the treated logs may also be floated.

UNITED KINGDOM

• The improved standards of accommodation demanded for fishing vessels have led to the introduction of many new materials throughout the accommodation spaces, and for furniture and upholstery. The fundamental requirements are that the materials should be capable of standing up to hard service conditions and the marine atmosphere. They should be fireproof or reasonably fireproof and also resistant to attack by vermin.

Cabin bulkheads and furniture are constructed from synthetic materials derived from a mixture of wood fibers and a synthetic resin such as Weyroc or Holoplast, the latter being of hollow form. These materials are said to be resistant to water, oil and acids and have good fire resisting properties. They are also impervious to attack by vermin. One advantage of these materials is that they can be supplied in a number of colours. They are easy to cut and form and in the case of the hollow panels, give good sound and heat insulation.

In all large modern fishing ports in Great Britain, wood for crates and boxes, kits and all handling receptacles is being superseded by aluminium. The fish is landed in specially constructed boxes or kits and subsequently transported in lidded boxes or liner crates to the wholesale market and retailer. The boxes and kits are entirely of aluminium whilst the liner crates consist of a wood slatted crate in which is a detachable pressed lining of aluminium, the lid being sheathed with the same material.

UNITED STATES OF AMERICA

• A portable sawmill using a band saw for the head-rig has been designed and used by a lumber company in the State of Washington, to improve utilization in 100-year-old second-growth Douglas-fir stands averaging 24 inches (61 cm.) d.b.h. and 58 M board feet per acre (650 m³ per ha.). Logging and sawmilling are fully integrated. About 6 percent more lumber volume per acre was obtained than by other methods and, compared with the general average for the area in similar stands, the new practices reduced logging residuals by 70 percent. The mill can profitably handle chunks and tops of 5-inch (12.7 cm.) top diameter that will produce logs 4 × 4 inches (10 × 10 cm.) and 8 feet (2.4 m.) long. The total investment in the unit is about $ 86,000 and production required 4.4 man-hours per M board feet (4.53 m³) lumber tally.

Forest Policy

CHILE

• The *Departamento de Bosques* of the Ministry of Lands and Colonization has been raised to the status of a *Dirección*. The new organization comprises a director (*director agronomo*), 11 forestry technicians in the higher grades (*tecnico forestal* or *agronomo*) and 33 in the lower grades (*tecnico forestal*). Señor Hernan Valenzuela R. has been appointed Director of the new organization and has the distinction and responsibility of being Chile's first Director of Forests.

FINLAND

• Laws against destructive forest cutting have long been in force in Finland. For instance, the 1886 forest law included some clearly defined regulations for the prevention of fellings causing devastation, which were, however, not very effective in practice, mainly because they were not satisfactorily enforced. Only when the present private forest law, promulgated in 1928, and the accompanying regulations came into force,

was there a great improvement in forest protection and private forestry.

This law, although a good basis for the management and utilization of the most important Finnish forests, is no longer abreast of developments in forestry and is not sufficiently flexible. For this reason the Government has appointed a committee to make proposals for the revision of legislation relating to private forests.

India

• In pursuance of the new forest policy published by the Government of India on 12 May 1952 and the recommendations made by the planning commission set up at that time, progress has been maintained in co-ordinating the activities of the Forest Departments of the various States, aiming at all-round development. Some of the measures taken by State Governments to implement the national policy are as follows:

1. Sustained efforts to educate public opinion in the value of forests, principally through the *Vana Mahotsava* (Grow More Trees Campaign) and *Vana Premi Sangh* (Forest Lovers Association).
2. Steps have been taken by some State Governments, notably Uttar Pradesh, Bihar and Bhopal, to control the management of private forests although these are for the most part passing to Government ownership as a result of land reform.
3. Some States have laid down the percentage of land to be kept under forests; in the case of Orissa 35 percent of the total land area, and for Bihar 20 percent.
4. The Government of Orissa has set up a Land Utilization Board and Bihar has initiated action for undertaking a detailed survey of all waste land with a view to its most appropriate utilization.
5. Some States have framed their own legislative measures to protect wildlife, after the passing of a resolution in April 1952 setting up a Central Board for Wildlife.

Other projects now being carried out under the new forest policy are:

1. Afforestation to arrest the spread of the Rajasthan desert; areas were surveyed by officers of the Central Government, constructive proposals made to tackle the problem and an experimental station set up at Jodhpur. The question of the after-care of the planted areas has been given particular attention, and the retaining of residuary powers of legislation considered, in order to compel the local inhabitants to subordinate individual interests to the scheme as a whole. These methods have also been applied to similar areas afforested in the State of Madras along the banks of the Hagari.

2. Exploitation of the forests of the North Andaman Islands: this project, inaugurated in 1951 has progressed satisfactorily, and it is anticipated that as extraction of hard and soft timber proceeds, the present scarcity of timber of all kinds in India itself will be greatly eased.

3. An expedition to the Great Nicobar islands disclosed that on a sustained yield basis over a rotation of 100 years, these islands can produce about 30,000 tons of timber a year, or one-quarter of the yield of the North and South Andaman islands. As fresh water is plentiful, these islands provide a better opportunity for colonization than the Andamans.

4. Research at the Forest Research Institute, Dehra Dun, has been directed mainly to the utilization of products at present considered useless or of low economic value, and achievements are reported in connection with the following products — Friol paint, Santonin, Vetiveria oil. A number of broadleaved species and grasses have been tested for the production of chemical pulp for the manufacture of writing and printing papers and newsprint, of which some were found suitable. (It may be noted that an entire edition of the newspaper *The Statesman* has been successfully printed on paper made in India from 70 percent bagasse pulp and 30 percent bamboo pulp).

Lastly, for the purpose of integrating forest policy as applied throughout the various States, the Government of India has set up a Central Board of Forestry with the Minister for Food and Agriculture as Chairman. The Board, composed of Forestry Ministers of the various States, will meet at least once every two years, and has the power to appoint technical committees to consider such inter-state matters as the training of officers, timber standardization, and flood control and anti-erosion measures.

Italy

• A law promulgated on 25 July 1952 outlines a general pattern for technical, economic and social advancement of all mountain areas and replaces all previous legislation which was inadequate to meet the pressing problems of the Italian mountain economy as a whole. The new law provides for loans and subsidies to private enterprise and allows combined governmental and private action where interests are involved.

The various fields of action envisaged by the law are: forestry, agriculture and livestock production, and last but not least public works, including water works, electric transformer stations, cableways, telephone networks, roads, etc. All these activities are to be co-ordinated by the State Forestry Corps, which comes under the General-Directorate for Forestry and Mountain Economy.

Rehabilitation plans are at present being drawn up for the 61 reclassified watershed areas; three are so far completed. Over 41 million lire have already been allocated to the local forestry bureaus for plans which are scheduled to be completed shortly and a further 500 million lire are being distributed among all reclassified areas in order to get work started on soil conservation.

Ryukyu Islands

• The results of a land use and forest resource survey are published in an economic report entitled *Ryukyu Islands Forest Situation*. This report, in addition to statistical data, includes an account of post-war developments in administration and management. Area statistics for land use have been established which now provide a basis for budgetary requirements in the field of natural resources, as well as for future detailed surveys to aid in resettlement programs.

Other developments include:

1. *Pine beetle control project*: this, the first of its kind to be initiated in the Ryukyu Islands, was carried out by the Forestry Bureau as a precautionary measure against the spread of infestations from Japan.

2. *Access road program*: the purpose of this program is to shift cutting from depleted accessible lands to the relatively inaccessible state forest lands.

3. *Publications*: in collaboration with the civil administration, the Forestry Bureau's Experimental Institute has published botanical and dendrological works as a basis for programs of economic development.

4. *Arbor Week*: the Ryukyu Arbor Week, inaugurated in 1951, has resulted in the planting of slightly over a million seedlings, or 1.1 seedlings per head of the total population.

5. *Forest law*: the present Ryukyu Forest Law was promulgated as a U.S. Civil Administration ordinance in August 1951 and prepared jointly by American and Japanese foresters. It sets forth a policy for uniting the administration of all forest land, in all ownership categories, under a single agency.

A *Forest Policy for the Ryukyu Islands*, prepared by an American consultant in timber management, has provided guidance in improving the management of state forests and in increasing sales of state forest stumpage on a sound silvicultural basis. Trespass and other abuses to which other state forest properties were subjected in post-war years from 1945-1950 have now been largely brought under control.

In April 1952 the Ryukyu Forestry Agency became the Forestry Bureau of the Government of the Ryukyu Islands.

Selected Reviews

THE FORESTER'S HANDBOOK. H. L. Edlin. pp. 395. Illus. Thames and Hudson Ltd. London. 1953. 35s.

This comprehensive book attempts to present field forestry in a practical manner for the land owner, land agent or forester in Britain. Its purpose is to inform the public for which it is written how results of the latest scientific research can be applied to the everyday problems of selecting species for planting and finding markets for timber. Factual data is given on methods, costs and quantities which will be of help in applying much of the information on seed collection and storage, nursery work, planting operations, natural regeneration methods, tending and thinning, tree felling, measurements and value of timber, marketing procedures, protection against insects, fungi and fire, and the establishment of shelterbelts and hedgerows, as well as the handling of parks and gardens. As is usually the case with such comprehensive works, it is difficult to choose the most useful subjects and to present practical guidance in enough detail to give maximum usefulness. The author has done this successfully on the whole, although some readers may wish to have more detailed information on their own particular problems. To assist such people there is a selected bibliography where more specific information can be obtained.

SILVICULTURAL SYSTEMS. R. S. Troup Revised by E. W. Jones. pp. 216. Illus. Oxford University Press. Oxford. 1952. 25s.

Continuing demand for this work — originally published in 1928 — has fully justified this new edition now revised and brought up to date by E. W. Jones.

No classification of systems can take account of all variants. Troup's plan is as follows:

I. High forest systems — crops normally of seedling origin:

A. Felling and regeneration for the time being concentrated on part of the area only — the clear-cutting, uniform group, irregular shelterwood, strip and wedge systems.

B. Felling and regeneration distributed continuously over the whole area, forest uneven aged — the selection system.

C. Accessory systems — the two-storied high forest and high forest with standards.

II. Coppice systems:

A. Crop entirely of vegetative shoots — the coppice and coppice selection systems.

B. Crop partly vegetative shoots and partly trees of seedling origin — the coppice with standards systems.

This rational approach avoids, on the one hand, attempts to apply a successful system slavishly to a quite different set of conditions and, on the other, leads to intelligent application where essential conditions are similar. One of Troup's prime beliefs is that European systems, modified with reason, are basically applicable in many types of forest, and examples in India and Malaya are given to support this belief.

During the past twenty years there have been major changes in appraising the advantages and disadvantages of the selection system, and in weighing the merits of *Dauerwald* — debate continues on both. These have been judiciously incorporated by the editor, as Troup himself might have done, and the work remains essentially his.

Broadly, the move is away from more rigid forms of silviculture with uniform crops and rigid management, toward more flexible forms, and hence more irregular forms of stands. Associated with this is a growing belief in the desirability of mixed stands.

There is a growing recognition that the biology of the forest is the essential basis for silviculture, that the dominance of economic considerations can lead to disaster. The irregular stand of mixed species, with canopy preserved, is believed to protect the soil better and more fully exploit the site. Recognition of the importance and potential of genetics is leading to a challenge to both clear-cutting and selection systems.

There have been changes in practice as well — the introduction of broadleaved species into stands of pure conifers, the increasing use of selection and wedge systems, while progress has been made in the natural regeneration of tropical forests of several categories. Much work is under way in coppice conversion and the reclamation of scrub in Europe — both difficult and not fully solved problems. Lastly there are the changing economic conditions — better communications, shifts in market requirements (in particular, less need for fuelwood and hence for coppice).

Some day yet a further revision will be needed to catch up with advances in method, practice and opinion, but then, as now, the solid basis of Troup's original work will stand, for few works have the same quality of timelessness.

FOREST REGENERATION IN ONTARIO. (University of Toronto. Forestry Bulletin No. 2). R. C. Hosie. pp. 134. Illus. University of Toronto Press. Toronto. 1953. Can. $ 3.50.

The Research Council of Ontario has sponsored this review of forest regeneration surveys which have been made at various intervals by government and private agencies in the province of Ontario.

Part 1 of the report attempts to summarize these surveys in order to present a true picture of regeneration conditions on cut-over land. Since the surveys were done at different times by various agencies, more or less independently, the methods and procedures used were not always the same. It was therefore difficult to make comparisons of the results. However, considerable useful information has been derived, particularly with regard to the field work and the interpretation of data of such surveys. The conclusions and recommendations emphasize the need for uniform standards in such work.

BOIS DU CONGO. (Timbers of the Congo). J. Fouarge, G. Gérard, E. Sacré. pp. 424. Tables and illustrations. Institut national pour l'étude agronomique du Congo belge. Brussels. 1953. Fr. 400.

This work gives the botanical and commercial names of about 41 tropical species belonging to 18 families, their general macroscopic and microscopic description, physical, mechanical and technological properties, natural resistance against insects and fungi and uses.

The results cannot claim to represent true average values as only a few samples of each species were available However, this publication certainly gives a very useful evaluation of them and should serve as a basis for more detailed studies. The practical experience behind this publication, the microphotos as well as a comprehensive bibliography of related literature make it a valuable guide for all who have to deal with African woods.

Roma. 1954 - S.p.A. Tipografica Castaldi, Via Casilina, 49

FOUR FAO AGRICULTURAL STUDIES ...

Improving the World's Grasslands

"It is an important contribution to the subject; the general reader will find it of interest, while the specialist will find it invaluable." Review in *World Crops*.

Published by Leonard Hill Ltd., 9 Eden Street NW, London, England. 1951, 147 pp., 107 illustrations, 12 tables. 10s.

Efficient Use of Fertilizers

This guidebook on fertilizers and their use in crop production is one of FAO's best sellers. The Spanish edition, which has been serialized six times in Latin America and Spain, is now in its second printing. The English edition has been reprinted commercially by Leonard Hill Ltd., London. 1949, 182 pp., 50 illustrations, tables, maps, charts (EFS) $ 2.00, 10s.

Soil Conservation: an International Study

This symposium has been described as the best short handbook on the subject in print. Second printing of the English Edition is now available. 1948, 189 pp., 96 illustrations, maps, charts, references (EFS) $ 2.00, 10s.

Legumes in Agriculture

More than the other successful FAO symposia (*Soil Conservation, The Efficient Use of Fertilizers* and *Improving the World's Grasslands*) this monograph brings together material nowhere else available in one place. 1953, xvi + 366 pp., (E) $ 3.00, 15s.

... AND OTHER PUBLICATIONS IN DEMAND

ON LAND USE

Soil Surveys for Land Development

Sufficient of the techniques of soil classification and mapping are outlined so that the mode of operation, the type of equipment involved and the cost of the work can be accurately assessed. Maps in color. Good bibliography. 1953, 110 pp., (E) $ 1.00, 5s.

Using Salty Land

Second printing of English edition available. 1948, 50 pp., tables, charts, references $ 0.50, 2s. 6d.

Weed Control by Growth-Regulating Substances

Third English printing. 1951, 36 pp., 5 illustrations, 2 tables (EFS) $ 0.50, 2s. 6d.

All three editions of this short book have sold rapidly and the Spanish and French editions have been serialized many times in the agricultural press.

ON LAND REFORM

Agricultural Development and Rural Reform in Denmark

FAO is now giving considerable attention to land tenure problems. This monograph covers not only the subject of land tenure, but also several aspects of agricultural development in Denmark closely associated with this subject, so that it can be considered as a significant contribution to the work of FAO in this field. 1953, 320 pp. (E) $ 3.00, 15s.

Consolidation of Fragmented Agricultural Holdings

A general analysis of the cause and effects of fragmentation and of preventive and remedial measures, supported by authoritative national studies of the problem contributed by Denmark, Ireland, Switzerland and France. 1950, 100 pp., 2 maps, 3 tables, (EFS) $ 1.00, 5s.

Communal Land Tenure

Sir Gerald Clauson, K.C.M.G., the author of this paper, was until recently a high official in the British Colonial Office in London. The paper is one of a group of connected studies on land tenure and related subjects to be published as part of the FAO programme of agrarian reform. 1953, 58 pp., (EFS) $ 0.50, 2s. 6d.

Cadastral Surveys and Records in Rights in Land

Sir Bernard Binns, K.B.E., author of this paper, was for five years head of the Department of Settlements and Land Records in Burma, and was also for two years, as Financial Commissioner, responsible for the whole land records administration of which the Land Records Department was an integral part. 1953, 68 pp., (EFS) $ 0.50, 2s. 6d.

Inter-Relationship between Agrarian Reform and Agricultural Development

This booklet is intended to show the influence that various types of land tenure and agrarian reform may exercise on agriculture development. It also tries to indicate the close complementary relationship between agricultural and industrial development. 65 pp., $ 0-75 3s. 9d.

DEVELOPMENT PAPERS

Water Laws in the United States of America

A selected reference list of publications with some reproductions, basic excerpts and a list of contents of special interest relating to water laws, irrigation, conservation, drainage and flood overflow protection for agricultural lands. 1950, 164 pp. multilith (E) $ 1.00, 5s.

Water Laws in Italy

Italy's legislation in this particular field has been chosen because of its long irrigation history, its background of Roman Law and customs which have been instrumental in shaping the laws of many modern countries, and because Italy possesses a simple and complete system of water laws. February 1953, iv + 28 pp. 25c, 1s. 3d.

Digest of Plant Quarantine Regulations

This edition revised the 1949 edition, bringing it up to date to August 1952. December 1952, vi + 164 pp. (EFS) $ 2.00, 10s.

Land Settlement for Agriculture

This paper attempts to outline the process of agricultural settlement and resettlement, to describe the various considerations and difficulties which may arise in connection with these operations. 1951, 40 pp. (EFS) $ 0.50 2s. 6d.

Cereal Breeding Procedures

This short handbook by Professor J. B. Harrington of the University of Saskatchewan, deals with the practical operations of a breeding program for wheat, rice and other small grains. viii + 124 pp. (EF) $ 1.25, 6s. 3d.

RECENT FAO FORESTRY PUBLICATIONS

Raw Materials for More Paper: *Pulping processes and procedures for testing*

These findings of an FAO Pulp and Paper Consultation in Rome, Italy, December 1952, form a short handbook covering pulping processes for fibrous raw materials from new sources and procedures recommended for the investigation of new raw materials for paper.

1953, 172 pp. (E) $ 2.00, 10s.

Forestry Abstracts Coverage List

Prepared by the Commonwealth Forestry Bureau from its card index of literature forming the basis of its quarterly publication, *Forestry Abstracts*, this list forms a comprehensive and well-tested collection of publications carrying material of significance to forestry.

1953, 180 pp. (E) $ 1.50, 7s. 6d.

Grazing and Forest Economy

This study is the combined work of the Forest Policy Branch of the Forestry Division, and deals with the problems as they affect temperate, tropical and arid regions.

1953, 199 pp. (EFS) $ 2.00, 10s.

Elements of Forest Fire Control

Fire prevention and control should be regarded as an integral part of forest management. This short study outlines the organization and administration involved in a protection program.

1953, 110 pp. (EFS) $ 1.00, 5s.

Research in Forestry and Forest Products

This world directory of research institutions gives an outline of their objectives and summaries of their activities.

1953, 324 pp. (E) $ 3.00, 15s.

Directory of Forestry Schools

A provisional list of forestry schools throughout the world giving information on their facilities for foreign students, curricula (theoretical and field work) and degrees awarded.

1953, 299 pp. (E) $ 3.00, 15s.

In active preparation:

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Tractors for Logging

World Festival of Trees

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